Using EViews

For *Principles of Econometrics, Fourth Edition*

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Bill Griffiths dedicates this work to Jill, David and Wendy Griffiths

Carter Hill dedicates this work to his wife, Melissa Waters

Guay Lim dedicates this work to Tony Meagher

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PREFACE

This book is a supplement to *Principles of Econometrics, 4th Edition* by R. Carter Hill, William E. Griffiths and Guay C. Lim (Wiley, 2011), hereinafter *POE4*. It is designed for students to learn the econometric software package EViews at the same time as they are using *POE4* to learn econometrics. It is not a substitute for *POE4*, nor is it a stand-alone computer manual. It is a companion to the textbook, showing how to do all the examples in *POE4* using EViews Version 7. For most students, econometrics only has real meaning after they are able to use it to analyze data sets, interpret results, and draw conclusions. EViews is an ideal vehicle for achieving these objectives. Others who wish to learn and practice econometrics, such as instructors and researchers, will also benefit from using this book in conjunction with *POE4*.

EViews is a very powerful and user-friendly program that is ideally suited for classroom use. You can find further details at the website **http://www.eviews.com**. The registration key that accompanies this book entitles you to download the Student Version of EViews 7 from this website. While the Student Version is perfectly adequate for handling most of the examples and exercises in POE4, it does have some limitations. A precise statement of these limitations relative to the capabilities of the full version of EViews is provided on the next page. Note that, unless you want to save a workfile, the Student Version will handle large data sets without any problems. Also, saving is often possible after deleting objects that are no longer relevant. Many students will, of course, have access to the full version of EViews in computer laboratories on campus.

The EViews workfiles for all the examples in *POE4*, and corresponding text definition files of the form ****.def***, can be found at **http://www.wiley.com/college/hill**. These data sets are also available at **http://principlesofeconometrics.com/poe4/poe4.htm**, along with errata for this book and for *POE4*.

With the exception of Chapter 1, the chapters in this book parallel the chapters in *POE4*. Thus, if you seek help for the examples in Chapter 11 of *POE4*, check Chapter 11 in this book. However, within a chapter, the section numbers in *POE4* do not necessarily correspond to the sections in this EViews supplement.

We welcome comments on this book and suggestions for improvement. We would like to acknowledge the valuable assistance of David Lilien, Glenn Sueyoshi, and Gareth Thomas from Quantitative Micro Software, the company that develops and distributes EViews. Of course, David, Glenn, Gareth and EViews are not responsible for any blunders that we may have committed.

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The Student Version of EViews 7

The EViews Student Version allows students to analyze datasets whose size is limited only by available computer memory. Instead of imposing hard limits on the size of datasets, the Student Version places "soft" capacity restrictions on the amount of data (1,500 observations per series, 15,000 total observations, 60 objects) that may be saved or exported. Students may, without restriction, work with larger amounts of data, but workfiles that exceed the soft limits may not be saved nor the data exported.

The Student Version is also restricted to interactive use since programming capabilities and batch-mode processing are not supported. Notable excluded features are X11, X12, and Tramo/Seats X-11 seasonal adjustment, solving model objects with more than 10 equations, storing EViews objects to databases, database autosearch, and redirection of print output to text or RTF files.

Lastly, the EViews Student Version license restricts use to a single machine by a single user. The user must be a currently enrolled student or currently employed faculty member. Note specifically that the restriction of the license to a single user implies that the Student Version is not licensed for use on public-access computers. The continued use of the Student Version beyond a 14-day grace period requires product activation/registration. Product activation takes seconds to perform using our automatic registration feature (for internet-connected computers). Registration may also be performed manually after obtaining a registration key via web browser or by contacting IHS EViews by telephone. In addition, the Student Version License will expire two (2) years after first use, and the Student Version will no longer run two years after the first activation.

BRIEF CONTENTS

CONTENTS

CHAPTER 1

Introduction to EViews 7.1

CHAPTER OUTLINE

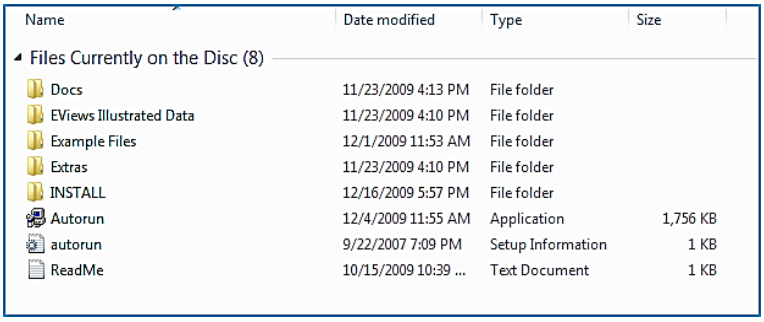
1.1 USING EVIEWS FOR PRINCIPLES OF ECONOMETRICS, 4E

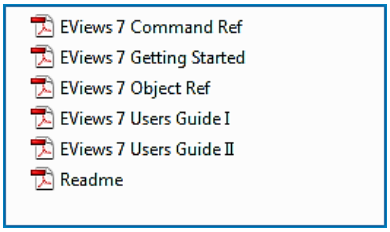
This manual is a supplement to the textbook *Principles of Econometrics, 4th edition*, by Hill, Griffiths and Lim (John Wiley & Sons, Inc., 2011). It is not in itself an econometrics book, nor is it a complete computer manual. Rather it is a step-by-step guide to using EViews 7.1 for the empirical examples in *Principles of Econometrics, 4th edition*, which we will abbreviate as *POE4*. We imagine you sitting at a computer with your *POE4* text and *Using EViews for Principles of Econometrics, 4th edition* open, following along with the manual to replicate the

examples in *POE4*. Before you can do this you must install EViews and obtain the EViews "*workfiles*," which are documents that contain the actual data.

1.1.1 Installing EViews 7.1

EViews 7.1 is distributed on a single CD-ROM. Its contents are:

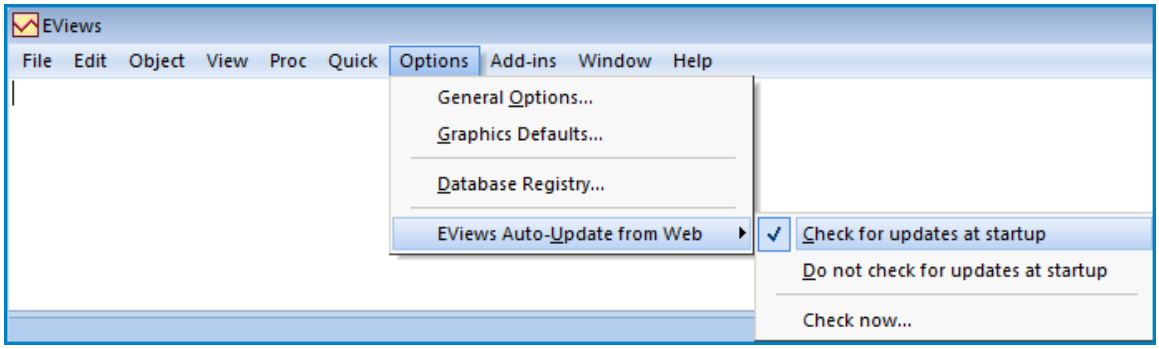




Within the Docs folder is a booklet called "EViews 7 Getting Started." It describes the installation and registration process. EViews is a Windows-based program. First close all other applications, then insert the CD into your computer's drive and wait until the setup program launches. If the CD does not spin-up on its own, navigate to the CD drive using Windows Explorer, and click on the Setup icon (AUTORUN.EXE).

1.1.2 Checking for updates

Once installed you should visit www.eviews.com and check the "**download**" link. There you will find any updates for your software. Alternatively, once EViews is installed set EViews to automatically update.



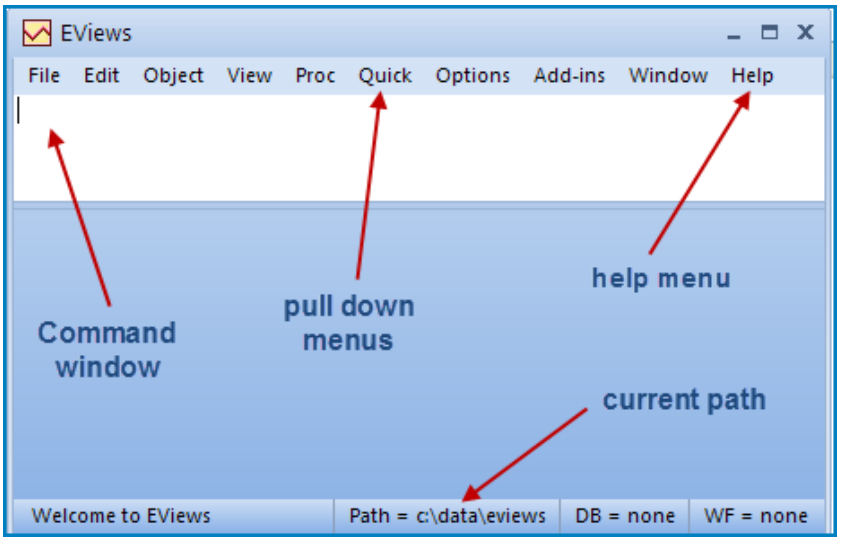
1.1.3 Obtaining data workfiles

The **EViews data workfiles** (with extension *.wf1) and other resources for *POE4* can be found at www.wiley.com/college/hill[1]. Find the link "Online resources for students." The *POE4* workfiles can be downloaded in a compressed format, saved to a subdirectory (we use c:\data\eviews), and then expanded. In addition to the EViews workfiles, there are **data definition** files (*.def) that describe the variables and show some summary statistics. The definition files are simple text files that can be opened with utilities like Notepad or Wordpad, or using a word processor. These files should be downloaded as well. Individual EViews workfiles, definition files, and other resources can be obtained from the author website www.principlesofeconometrics.com.

1.2 STARTING EVIEWS

To launch EViews, double-click the EViews 7 icon on the desktop, if one is present. It should resemble

Alternatively, select EViews 7 from the Windows Start Menu. When EViews opens you are presented with the following screen:

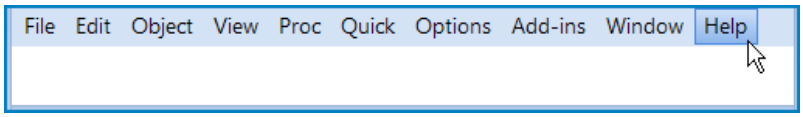


Across the top are **Drop Down Menus** that make implementing EViews procedures quite simple. Below the menu items is the **Command window**. It can be used as an alternative to the menus, once you become familiar with basic commands and syntax. Across the bottom is the **Current Path** for reading data and saving files. To change this, double-click path name and browse for a new folder. The EViews **Help Menu** is going to become a close friend.

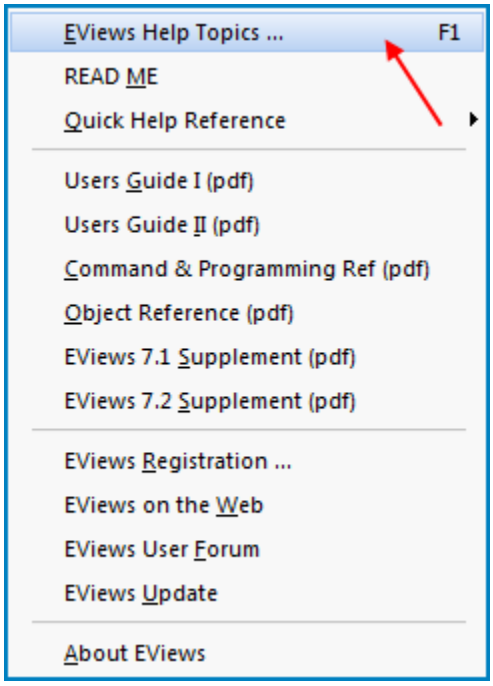
[1] There are a number of books listed by authors named Hill. *POE4* will be one of them.

1.3 THE HELP SYSTEM

Click **Help** on the EViews menu:

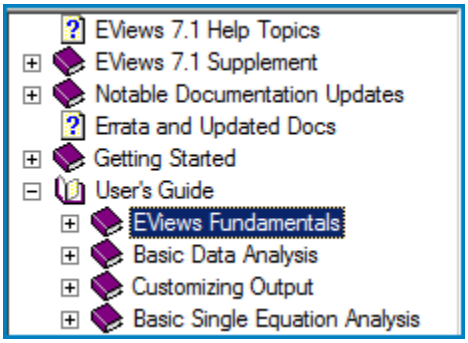


The resulting menu is



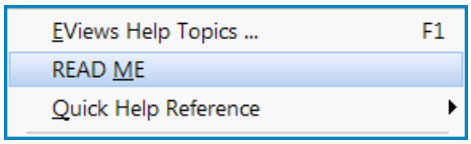
1.3.1 EViews help topics

First, click on **EViews Help Topics**. Select **User's Guide/EViews Fundamentals**. It opens a list of chapters that can take you through specifics of working with EViews. These guides will be a useful reference after you have progressed further through *Using EViews for POE4*.

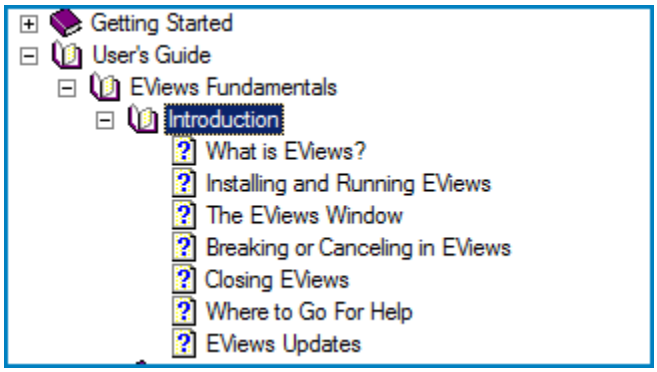


1.3.2 The read me file

On the **Help menu**, select **READ ME**. This opens a PDF file with the latest installation notes and errata.

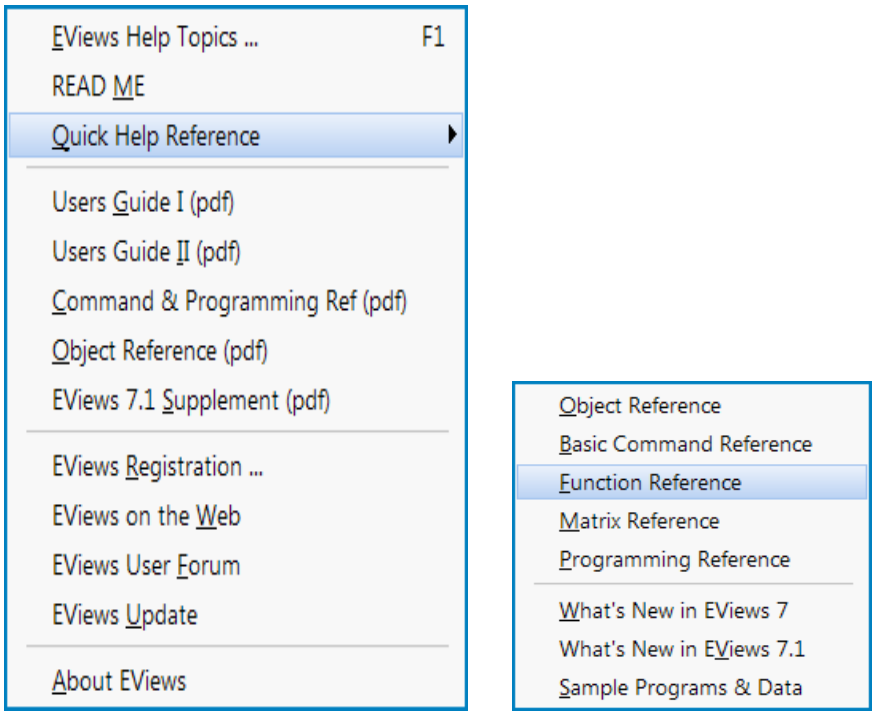


Some basic questions about EViews 7 are answered by clicking **Help/EViews Help Topics/ User's Guide/EViews Fundamentals/Introduction**.

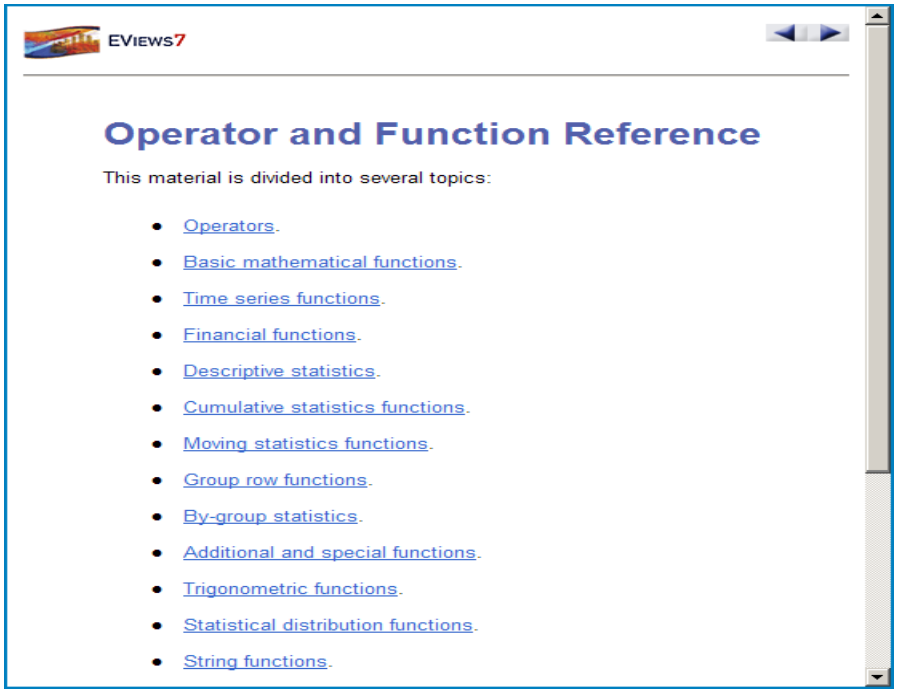


1.3.3 Quick help reference

Select **Quick Help Reference**. You find another menu. Select **Function Reference**.



EViews has many, many functions available for easy use.



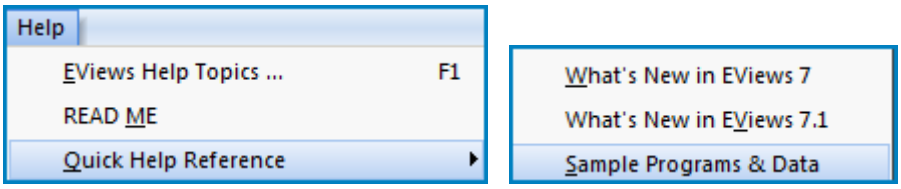
You should just take a moment to examine the **Operators** (basic addition, multiplication, etc.) and the **Basic mathematical functions** (square roots, logarithms, absolute value, etc.). This **Function Reference** help is one that you will use very frequently, and to which we will refer a great deal.

1.3.4 User's guides and command reference

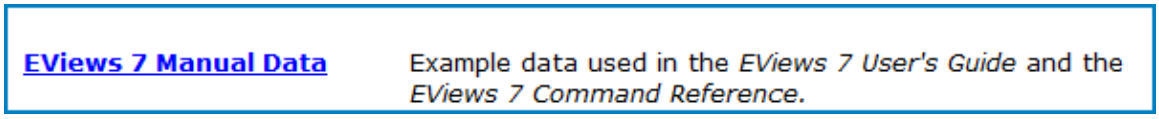
The User's Guide I, User's Guide II and Command Reference are the complete documentation for the full version of EViews 7. While these are good rainy-day reading, we do not necessarily suggest you search them for information until you are more familiar with the workings of EViews 7. This book, *Using EViews for POE4*, is an effort to guide you through the essentials of EViews 7 that are needed to replicate the examples in the book *POE4*.

1.4 USING A WORKFILE

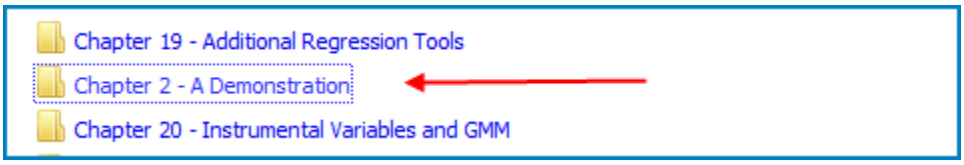
As noted earlier, all the data for the book *Principles of Econometrics, 4th edition* is provided as EViews **workfiles**. These will be used starting in Chapter 2. To illustrate some aspects of working with EViews we use a sample data set provided with the software called ***demo.wf1***. Under the Help menu, choose **Quick Help Reference/Sample Programs & Data:**



From among the choices select **EViews 7 Manual Data:**



In the list of topics open the folder for Chapter 2:



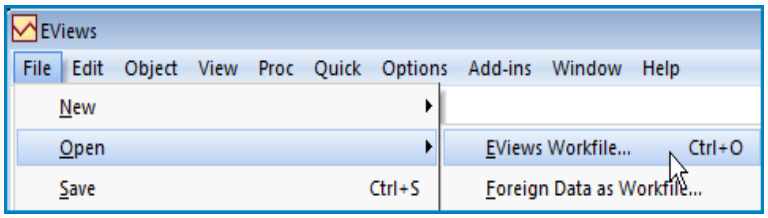
There you will find ***demo.wf1***.

Double-clicking the icon for ***demo.wf1*** will open it with EViews. However it has some additional objects created during the EViews demonstration. The plain EViews workfile ***demo.wf1*** can be found at www.principlesofeconometrics.com/eviews.htm. The contents of this workfile are described in the definition file ***demo.def***, which is a simple text file found at www.principlesofeconometrics.com/def.htm.

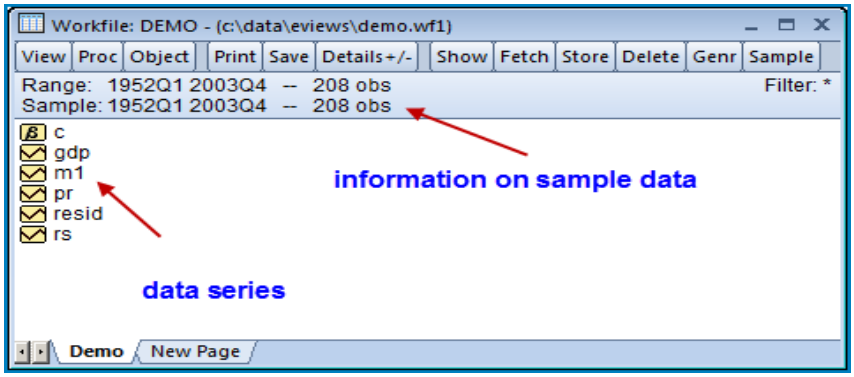
```
demo.def
         Obs: 180 households 1952.1 - 1996.4

         year               year
         qtr                quarter
         gdp                gross domestic product
         pr                 price level index
         m1                 money supply
         rs                 short term interest rate

    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
        year |       180        1974     13.0234       1952       1996
         qtr |       180         2.5    1.121153          1          4
         gdp |       180     632.419    564.2441     87.875   1948.225
          pr |       180    .5141061     .303483   .1975607   1.110511
          m1 |       180    445.0064    344.8315    126.537    1219.42
          rs |       180    5.412928    2.908939   .8143333   15.08733
```

1.4.1 Opening a workfile

Open the workfile called ***demo*** by clicking **File/Open/Workfile.**



Navigate to where you have stored your EViews workfiles, then select ***demo*** and click on **Open**.



Located on the left side are data series that are indicated by the icon . EViews calls the elements of the workfile **objects**. As you will discover, there are many types of objects that EViews can save into the workfile—not only series but tables, graphs, equations, and so on. As Richard Startz says, an object is a little "thingie" that computer programmers talk about. Each little icon "thingie" in the workfile is an object.

In this workfile the data series, or variables, are:

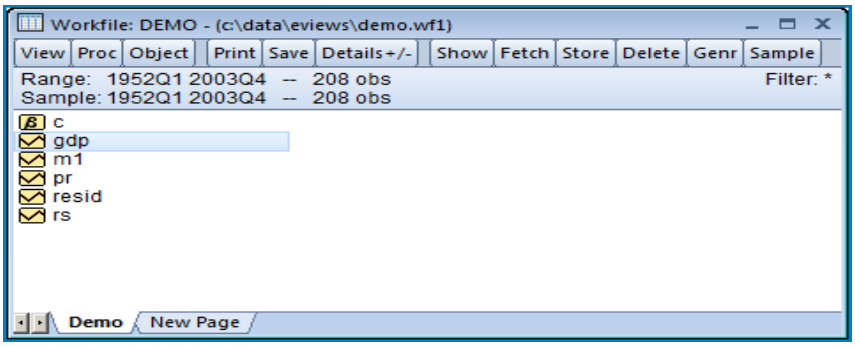
- *GDP*—gross domestic product
- *M1*—money supply
- *PR*—price level (index)
- *RS*—short term interest rate

The series **resid** and the icon labeled ***β*** are always present in EViews workfiles (even new ones with no data) and their use will be explained later. Across the top of the workfile are various buttons that initiate tasks in EViews, and these too will be explained later.

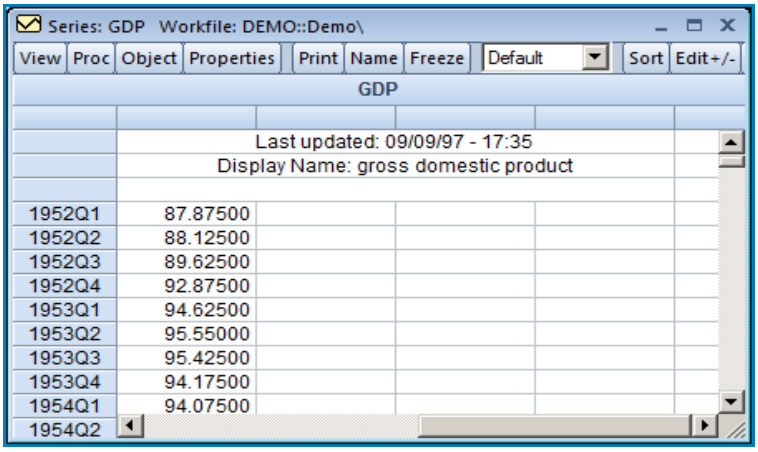
Below the buttons is **Range: 1952:1 2003:4**, which indicates that the 208 observations on the variables included run from 1952, Quarter 1, to 2003, Quarter 4. **Sample: 1952:1 2003:4** denotes the data observations EViews will use in calculations. Many times we will choose for analysis less than the full range of observations that are available, so **Sample** will differ from **Range**.

1.4.2 Examing a single series

It is a good idea each time you open a workfile to look at one or more series just to verify that the data are what you expect. First, select one series:

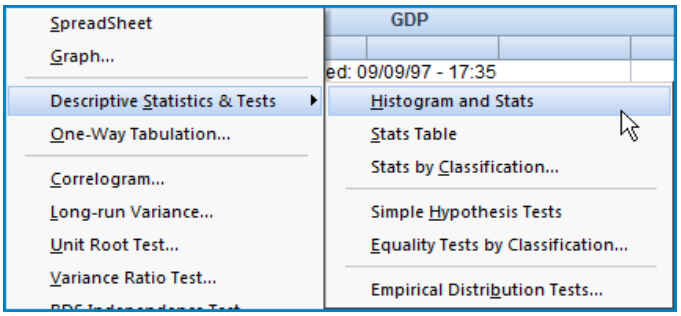


Double-click in the blue area, which will reveal a spreadsheet view of the data.

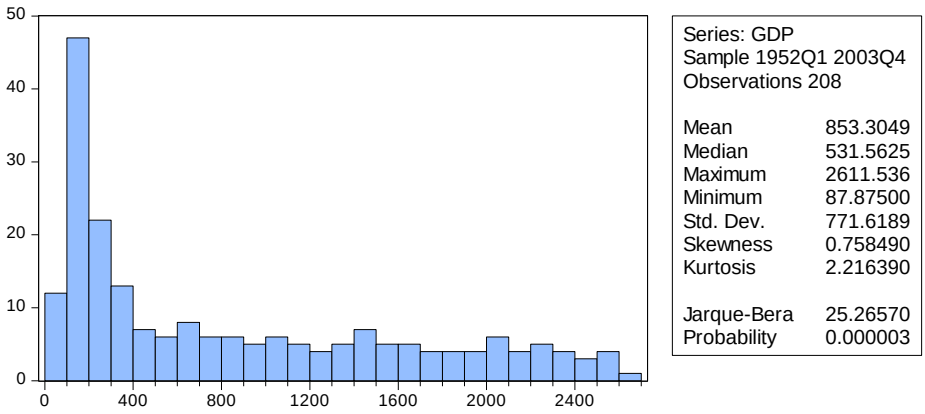


In the upper left hand corner is a button labeled **View:**

This opens a drop-down menu with a number of choices. Select **Descriptive Statistics & Tests/ Histogram and Stats**.

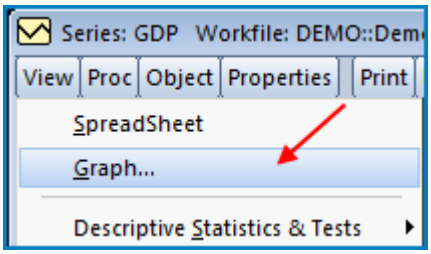


The result is

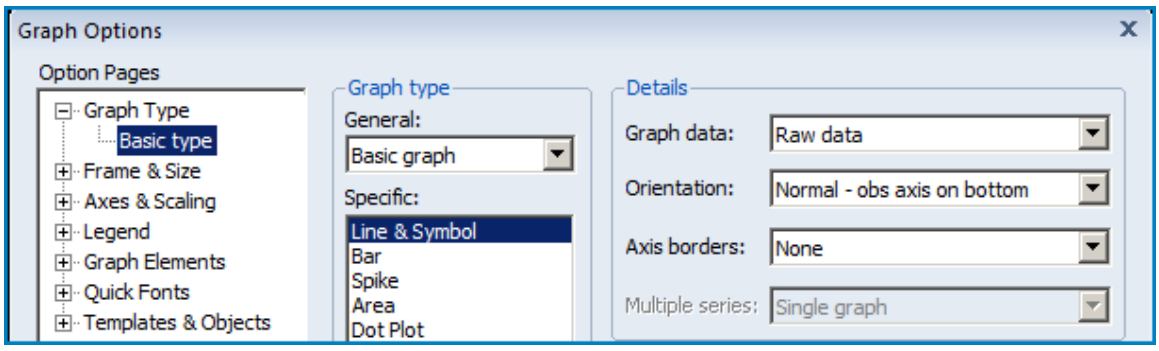


This histogram is shown with various summary statistics on the side.

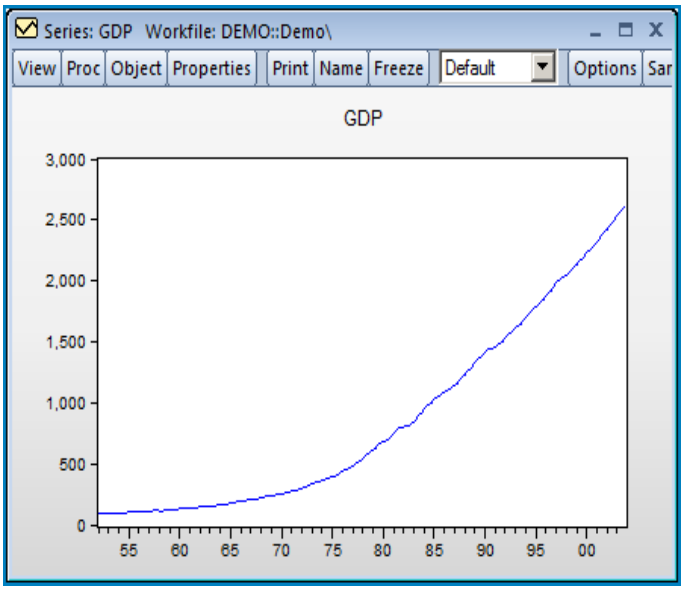
Click on **View** again. Select **Graph**.



There you will see many options. The default graph type is a **Basic Graph** with the **Line & Symbol** plotted. Select **OK**.

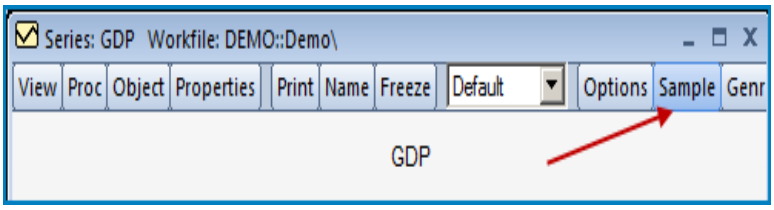


The result is a line graph. The dates are on the horizontal axis and *GDP* on the vertical axis.

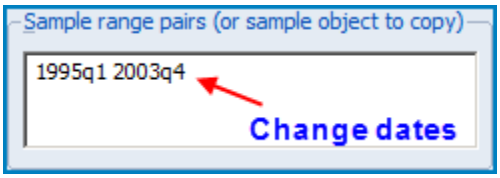


1.4.3 Changing the sample

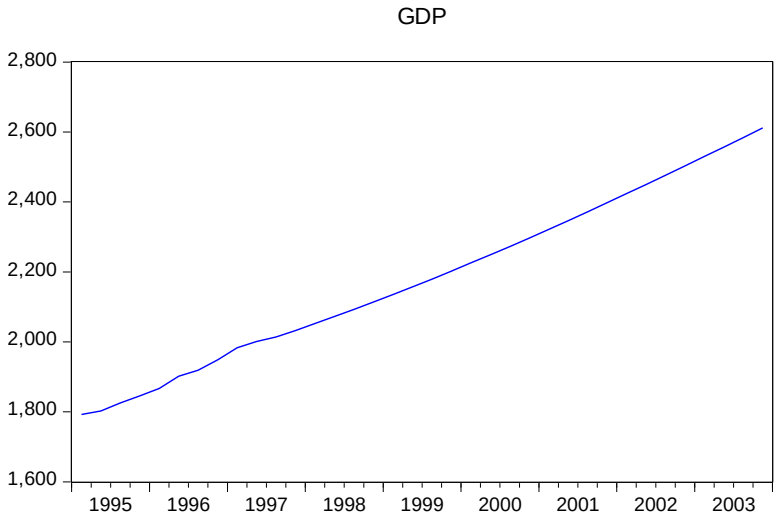
If you wish to view the graph or summary statistics for a different sample period, click on the **Sample** button. This feature works the same in all EViews windows.



In the dialog box that opens change the sample to 1995q1 to 2003q4, then click **OK**.



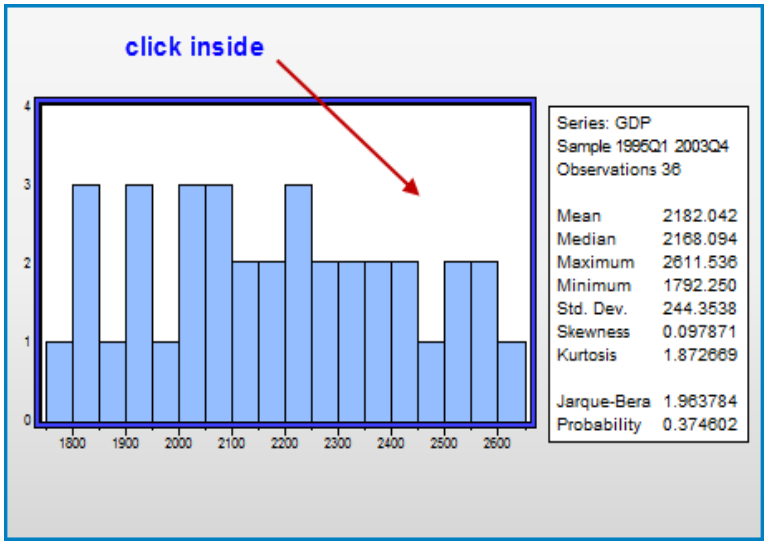
The resulting graph shows that *GDP* rose constantly during this period.



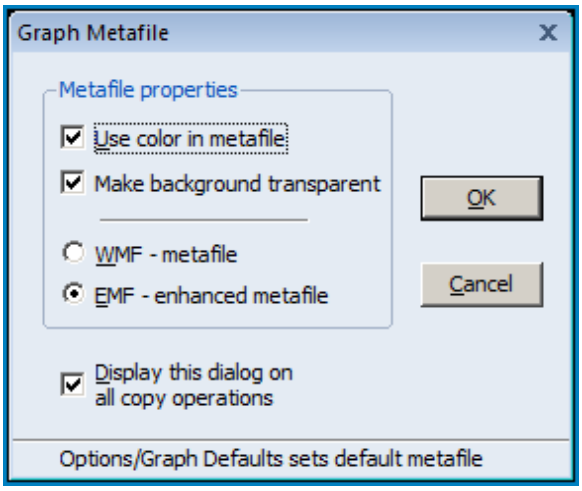
1.4.4 Copying a graph into a document

Select **View/Descriptive Statistics & Tests/Histogram and Stats**. You will now find the summary statistics and histogram of *GDP* for the period 1995:1 to 2003:4. These results can be printed by selecting the **Print** button.

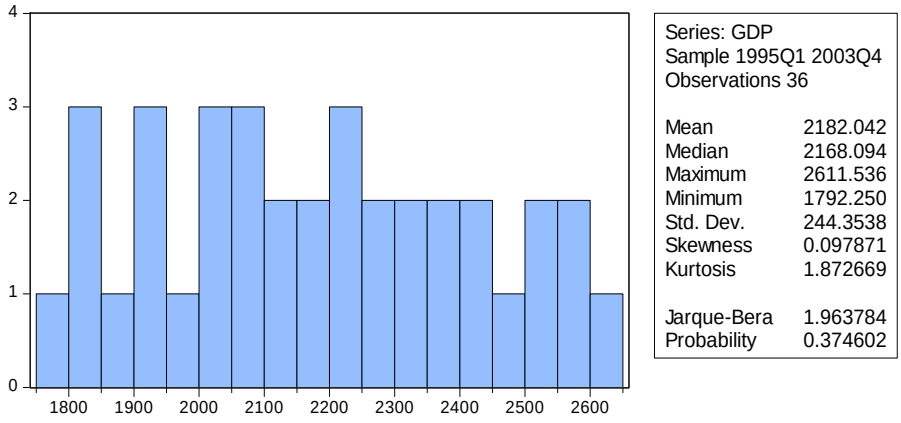
You may prefer to copy the results into a word processor for later editing and combining results. How can results be taken from EViews into a document? Click inside the histogram:



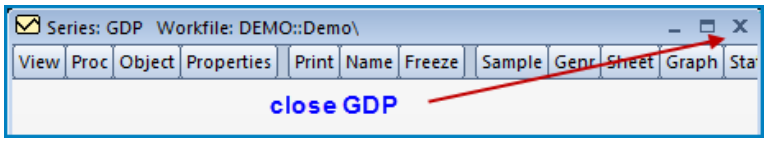
While holding down the **Ctrl** key, press **C** (which we will denote as **Ctrl+C**). This is the Windows keystroke combination for **Copy**.



In the resulting dialog box you can make some choices, then click **OK**. This copies the graph into the Windows clipboard (memory). Open a document in your word processor and enter **Ctrl+V,** which will **Paste** the figure into your document.

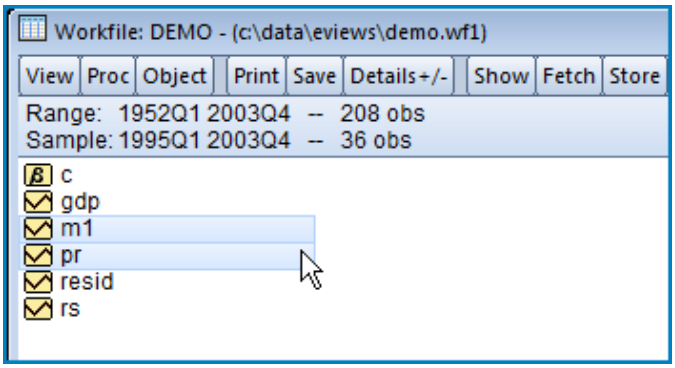


Close the graph we have been working on by clicking the **X** in the upper right-hand corner of the *GDP* screen:

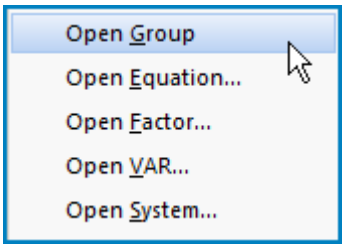


1.5 EXAMINING SEVERAL SERIES

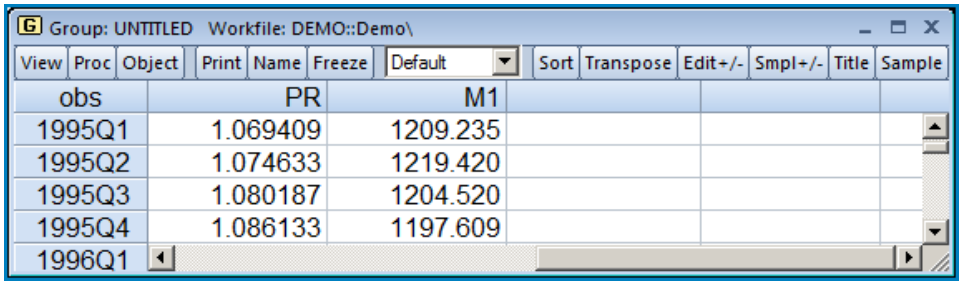
Rather than examining one series at a time, we can view several. In the workfile window select the series *M1* and then while holding down the **Ctrl**-key select the *PR* series. Double-click inside the blue area to open what is called a **Group** of variables.



Click on **Open Group**.



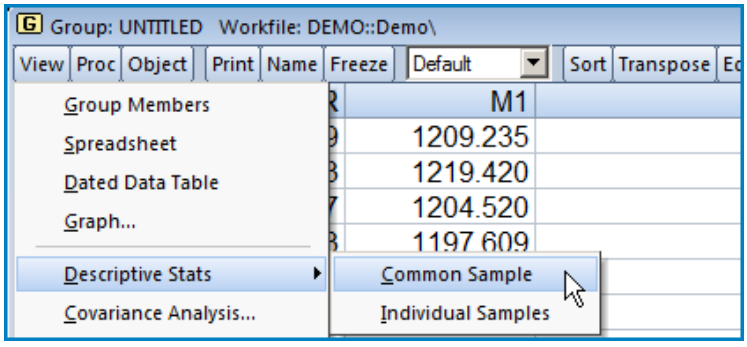
A spreadsheet view of the data will open.



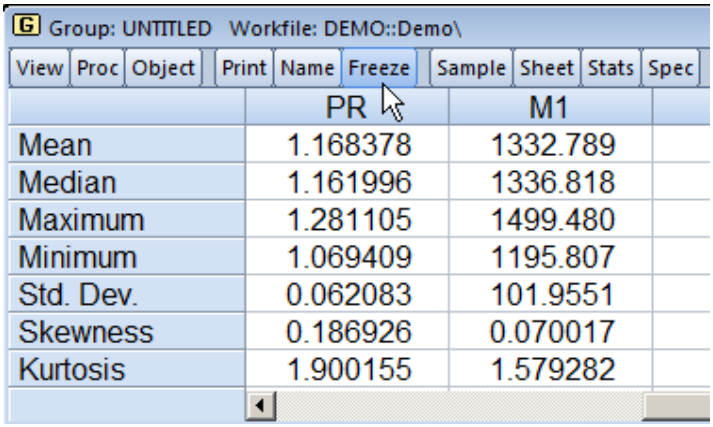
Note that the series begins in 1995:1 because we changed the **Sample** range in Section 1.4.3.

1.5.1 Summary statistics for several series

From the spreadsheet we can again examine the data by selecting the **View** button. Select **Descriptive Stats/Common Sample**.



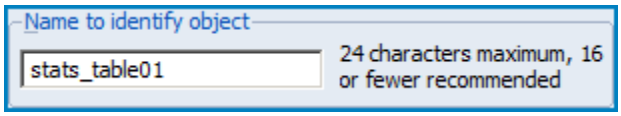
The result is that a table of summary statistics is created for the two series (variables) in the group.



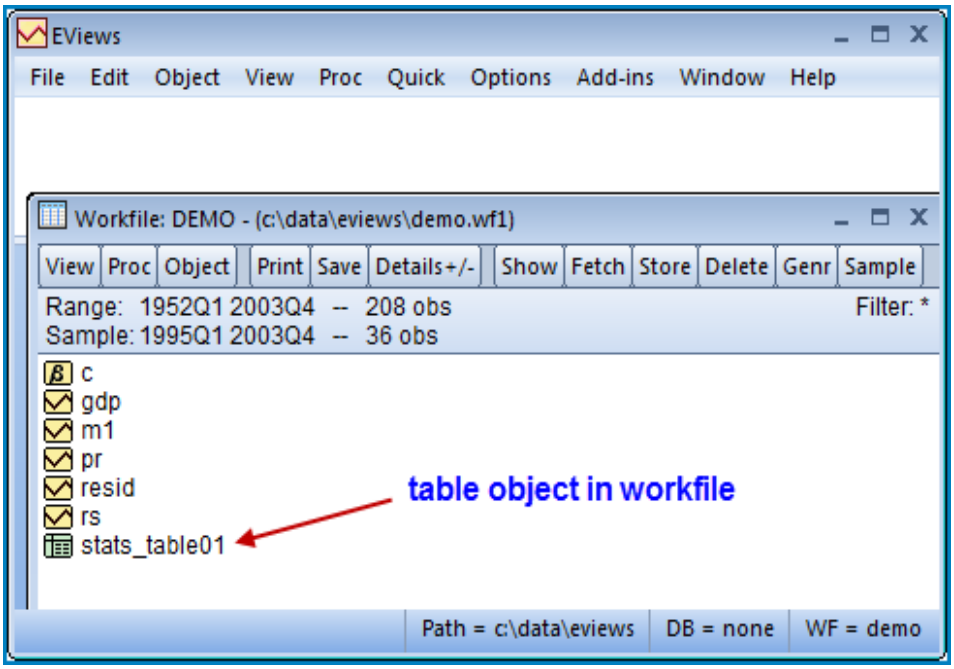
	PR	M1
Mean	1.168378	1332.789
Median	1.161996	1336.818
Maximum	1.281105	1499.480
Minimum	1.069409	1195.807
Std. Dev.	0.062083	101.9551
Skewness	0.186926	0.070017
Kurtosis	1.900155	1.579282

1.5.2 Freezing a result

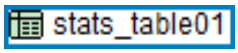
These results can be "saved" several ways. Select the **Freeze** button. This actually saves an image of the table. In the new image window, select the **Name** button. Enter a name for this image, which EViews calls an **Object**. The name should be relatively short and cannot contain any spaces. Underscores "_" can be used to separate words to make recognition easier.



Click **OK**, then close the **Object** by clicking on the **X**. Check back in the workfile and you will now see a new entry, which is the table you have created.

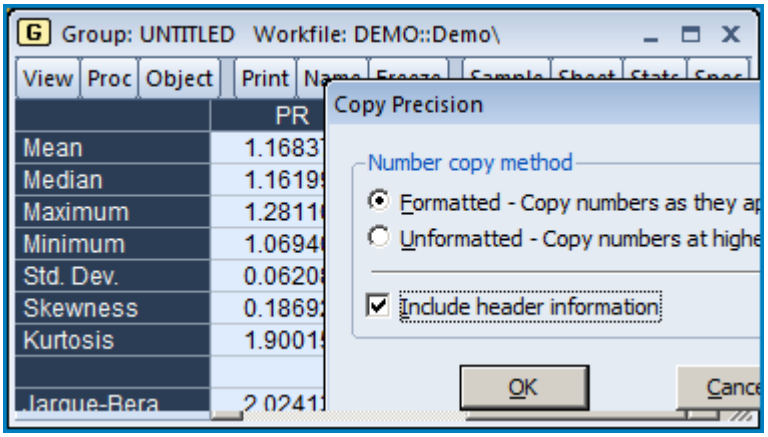


The table can be recalled at any time by double-clicking the **Table icon:**



1.5.3 Copying and pasting a table

To copy these into a document directly, highlight the table of results (drag the mouse while holding down its left button) and enter **Ctrl+C**. In the resulting box click the **Formatted** radio button, check the box **Include header information**, and click **OK**. This copies the table to the Windows clipboard, which then can be pasted (**Ctrl+V**) into an open document.

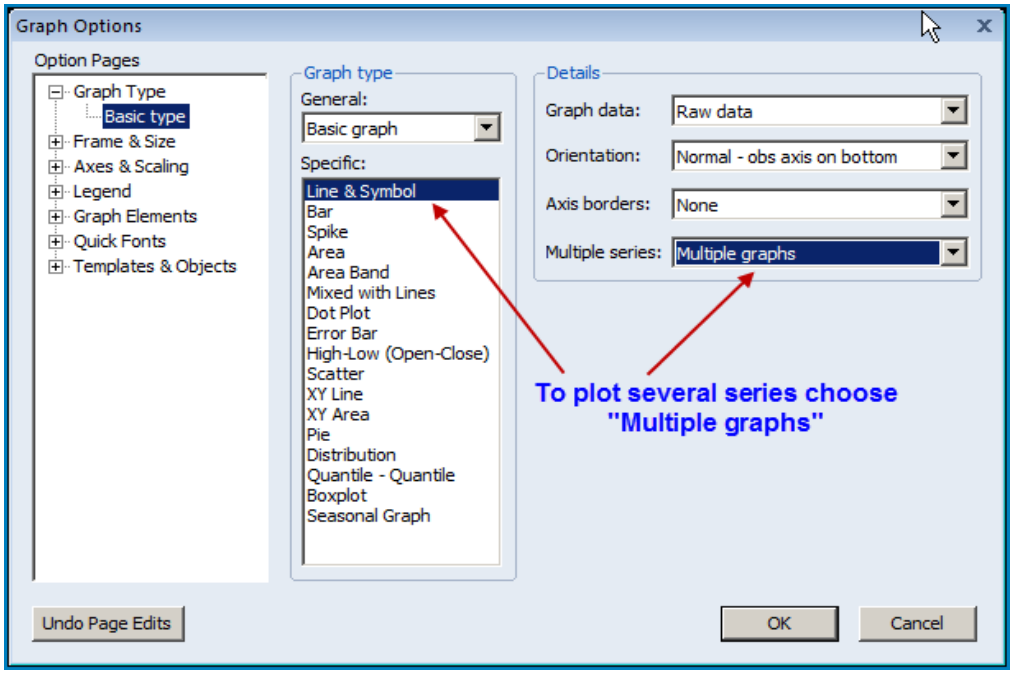


	M1	PR
Mean	1332.789	1.168378
Median	1336.818	1.161996
Maximum	1499.480	1.281105
Minimum	1195.807	1.069409
Std. Dev.	101.9551	0.062083
Skewness	0.070017	0.186926
Kurtosis	1.579282	1.900155
Jarque-Bera	3.057073	2.024137
Probability	0.216853	0.363466
Sum	47980.40	42.06160
Sum Sq. Dev.	363819.2	0.134901
Observations	36	36

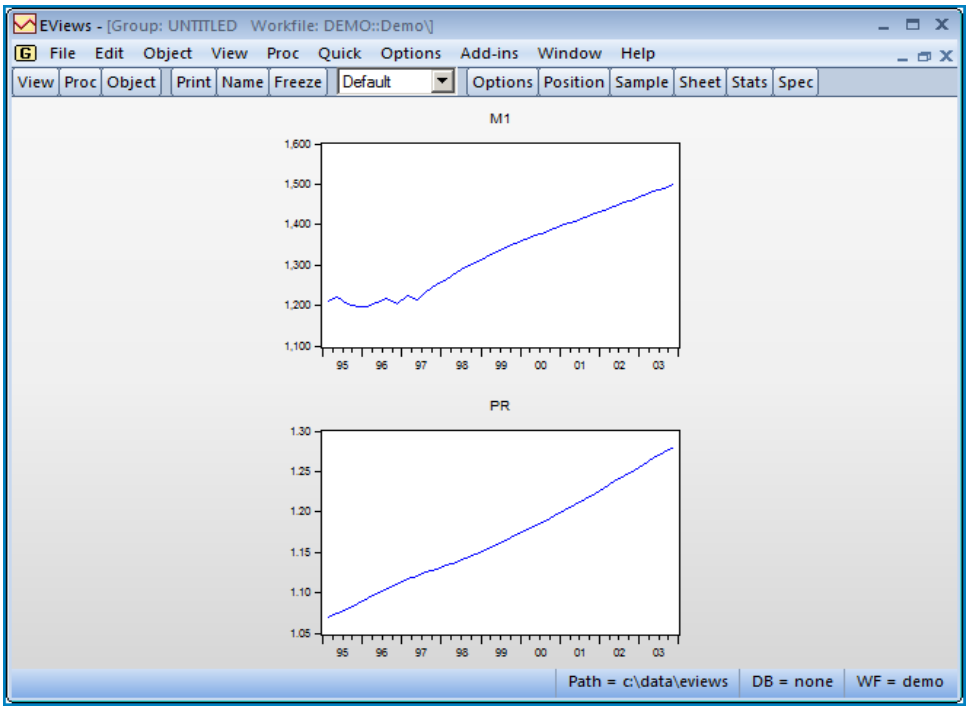
This same method can be used for any table in EViews. For example, if you open the saved table **STATS_TABLE01** you can highlight the results, then copy and paste as we have done here.

1.5.4 Plotting two series

Return to the spreadsheet view of the two series *M1* and *PR*. Select **View/Graph**. In the resulting dialog box, select **Multiple graphs** in the **Multiple series** menu.



Click **OK** to obtain two plots of the series.

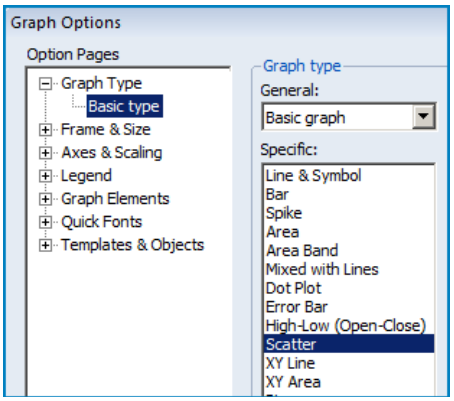


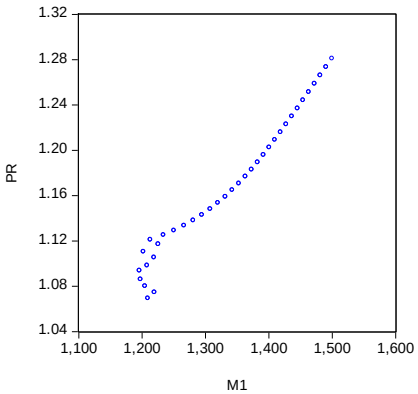
We can **Freeze** this picture, then assign it a **Name** for future reference.

1.5.5 A scatter diagram

A scatter diagram is a plot of data points with one variable on one axis and the other variable on the other axis. In the **Group** screen click **View/Graph**. For **Specific Graph type**, select **Scatter.**

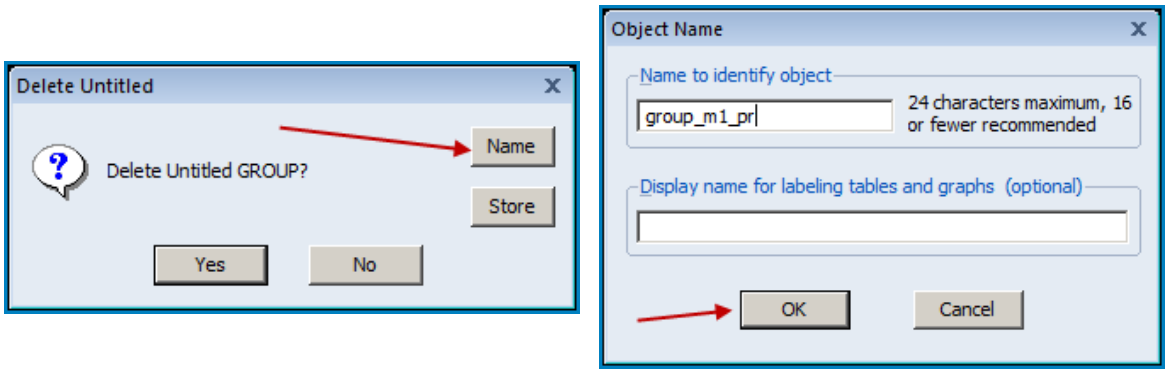
Click **OK**. Copy the graph by clicking inside the graph area and entering **Ctrl+C** to copy, then paste into a document using **Ctrl+V**. Recall that we are still operating with the sample from 1995:1 to 2003:4, which is only 36 data points.



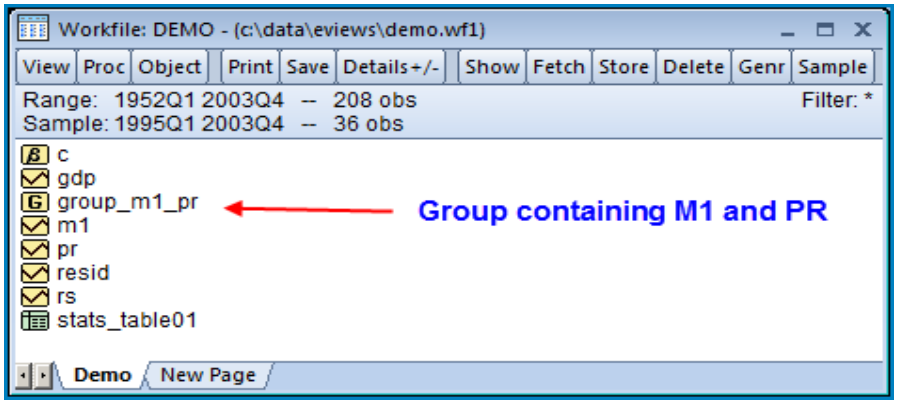


The variable *M1* is on the horizontal axis because it is the first series in the spreadsheet view.

Clicking the **X** in the Group window reveals some choices. The Group, consisting of the two series *M1* and *PR*, can be saved by selecting **Name** and assigning a name.

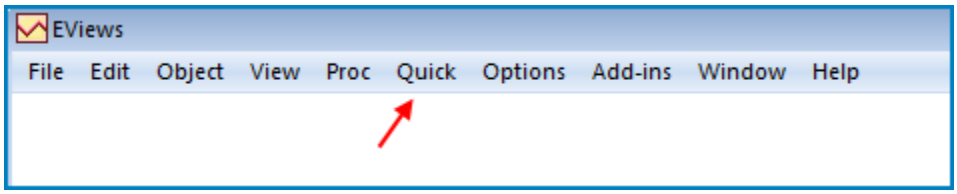


In the workfile window you will find a new object for this group.

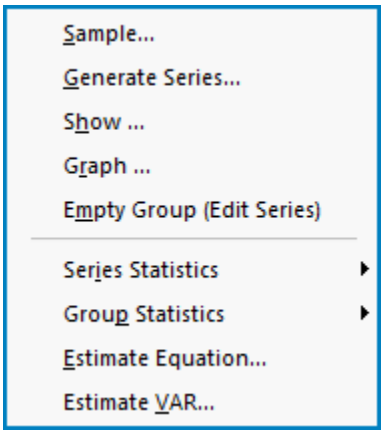


1.6 USING THE QUICK MENU

The spreadsheet view of the data is very powerful. Another key tool is the **Quick** menu on the EViews 7.1 workfile menu.

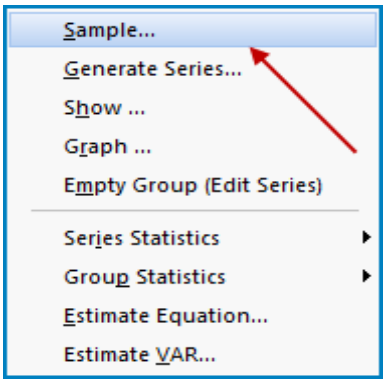


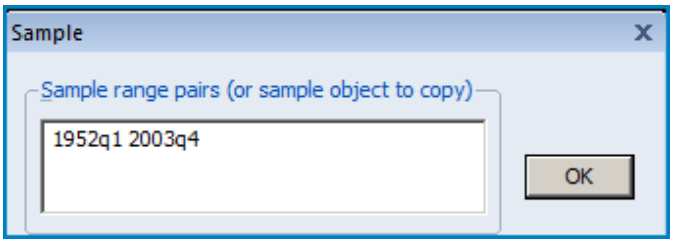
The options shown are



1.6.1 Changing the sample

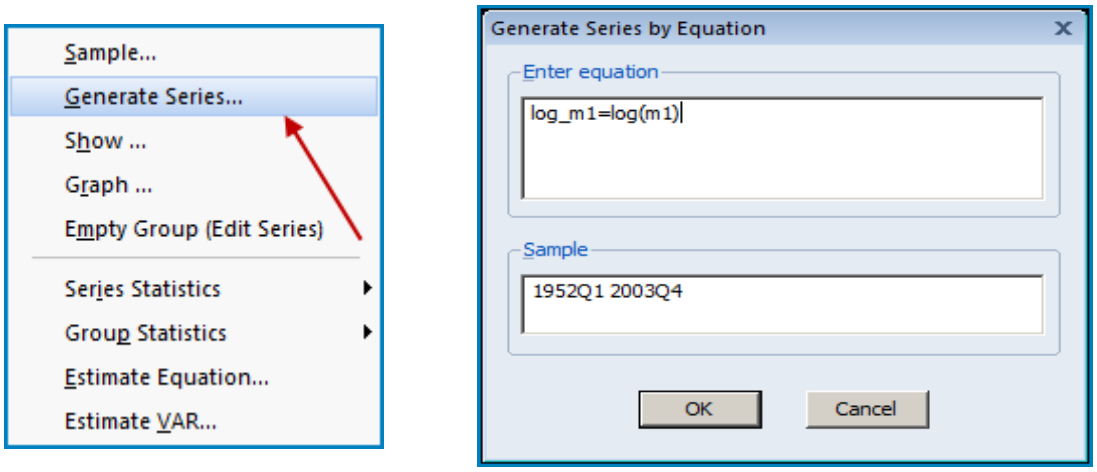
By selecting **Sample** from this menu we can change the range of sample observations. Change the sample to 1952:1 to 2003:4 and click **OK**.



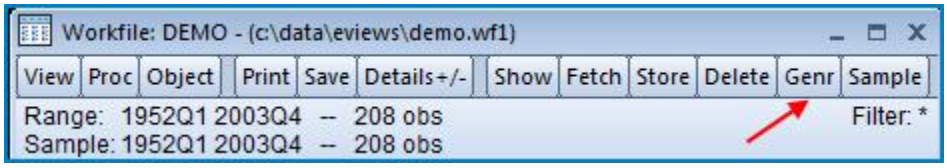


1.6.2 Generating a new series

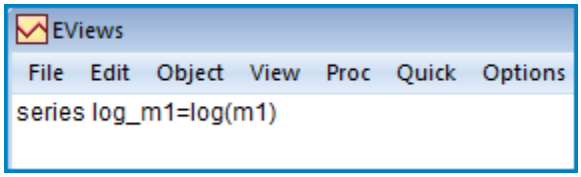
In each problem we may wish to create new series from the existing series. For example, we can create the natural logarithm of the series *M1*. Select **Quick/Generate Series**. In the resulting dialog box type in the equation **log_m1=log(m1)**, then click **OK**. A new series will appear in the workfile. The function **log** creates the natural logarithm. All logarithms used in *Principles of Econometrics* are natural logs.



Alternatively, we can generate a new series by selecting the **Genr** button on the workfile menu. This will open the same **Generate Series** dialog box.



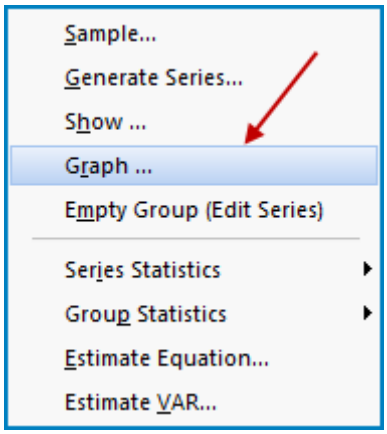
A third option is perhaps the simplest. Type into the EViews **Command window**

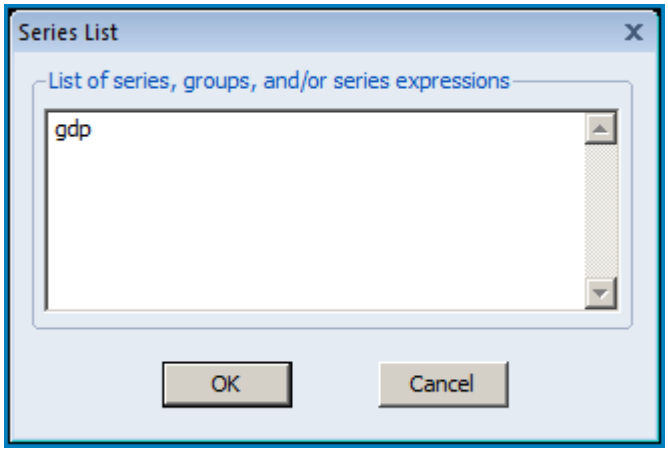


Then press **Enter**. Once a few basic commands are learned, a great deal of pointing-and-clicking can be avoided.

1.6.3 Plotting using Quick/Graph

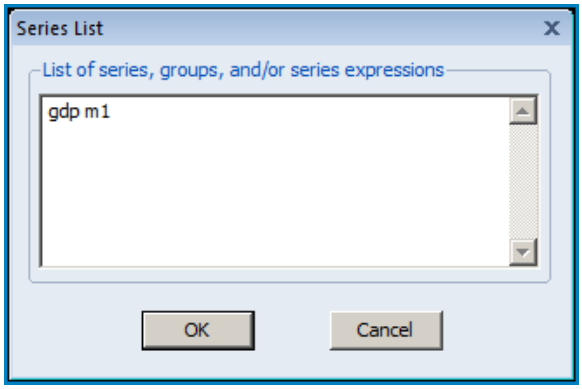
We can create graphs from the spreadsheet view, but we can also use **Quick/Graph**.

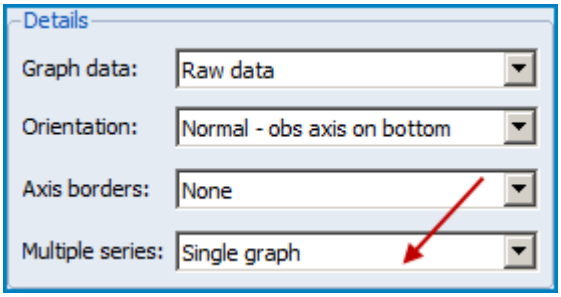




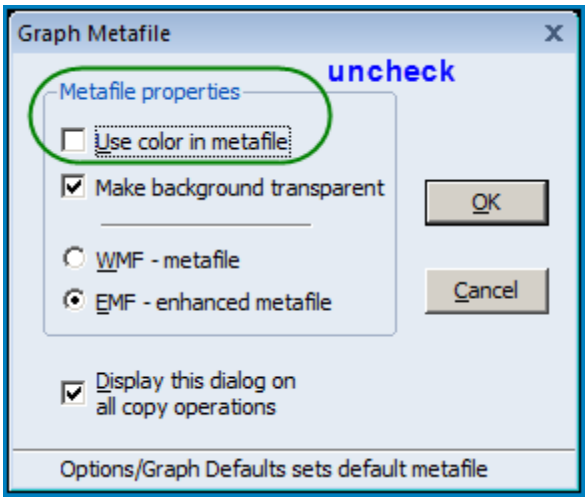
This will open the **Graph options** window. For a basic graph click **OK**.

If you enter two series into the **Series List** window then the **Graph options** window will have an additional option. Here we will plot the two series in a single graph.

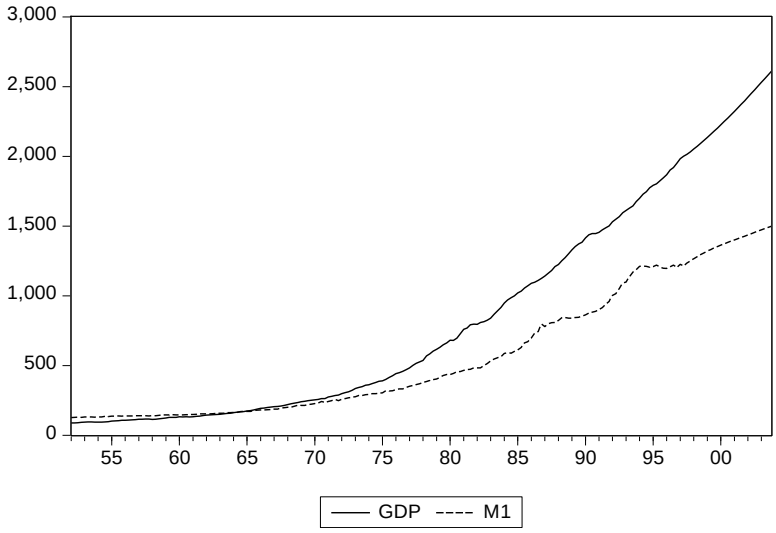




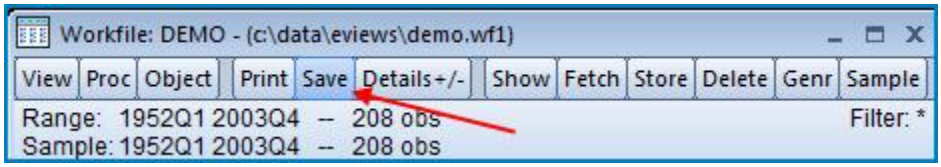
Click **OK**. The resulting graph shows the two series plots in a single window. In EViews the curves are in two different colors, but this will not show in a black and white document. The programmers at EViews have thought of this problem. Click inside the graph and enter **Ctrl+C** to copy. In the **Graph Metafile** box that opens, uncheck the box "**Use color in metafile**." Click **OK**.



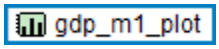
In your document enter **Ctrl+V** to paste the black and white graph.



Now the graph lines show up as solid for *GDP* and broken for *M1* so that the difference can be viewed.



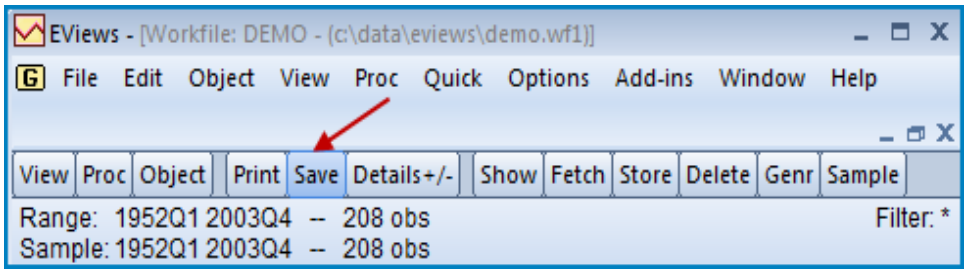
To save the graph, click **Name** and enter the name **GDP_M1_PLOT**. Click **OK**. Close the graph by clicking "**X**". You will find an icon in the workfile window.



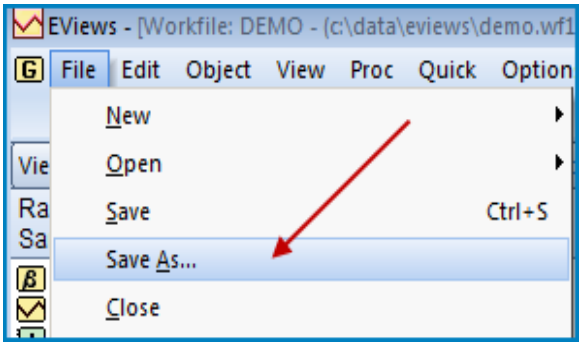
If you double-click this icon, up will pop the graph you have created.

1.6.4 Saving your workfile

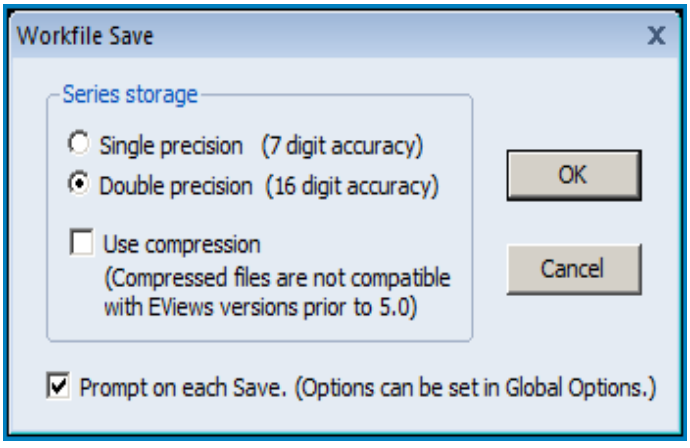
Now that you have put lots of work into creating new variables, plots, and so on, you can **Save** what you have done. On the workfile menu select the **Save** button



In the following window, if you click **OK** then all the objects you have created will be saved into the workfile ***demo.wf1***. You may wish to save these results using a different name, so that the original data workfile is not changed. To save the workfile, select **File/Save As** on the main EViews menu:



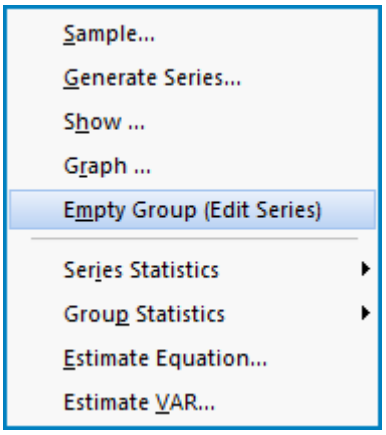
We will use the name ***demo_ch1.wf1*** for this workfile. Enter this and click **OK**. You will presented with some options. Use the default of **Double precision** and click **OK**.



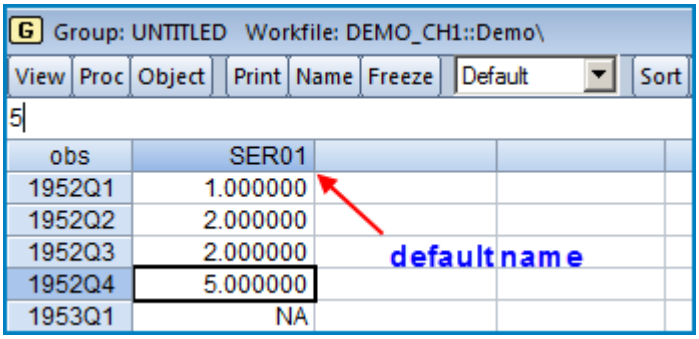
You will note that the workfile name has changed.

1.6.5 Opening an empty group

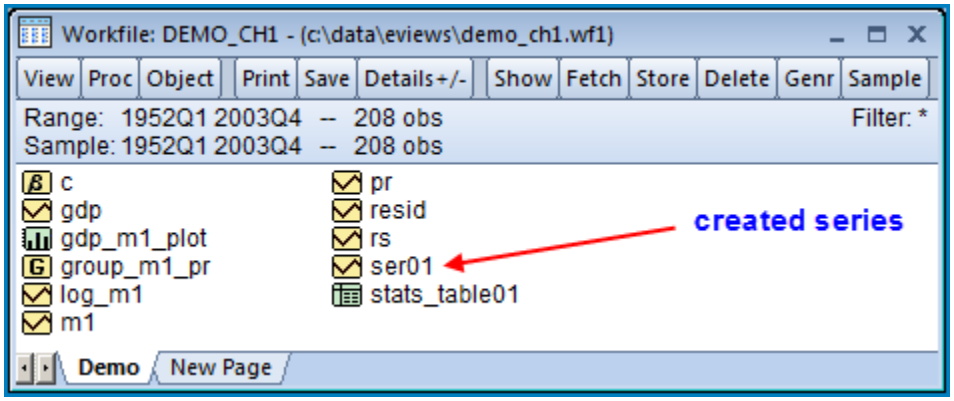
The ability to enter data manually is an important one. In Section 1.8 we show several ways you might enter data into EViews. Select **Quick/Empty Group (Edit Series)** from the EViews menu.



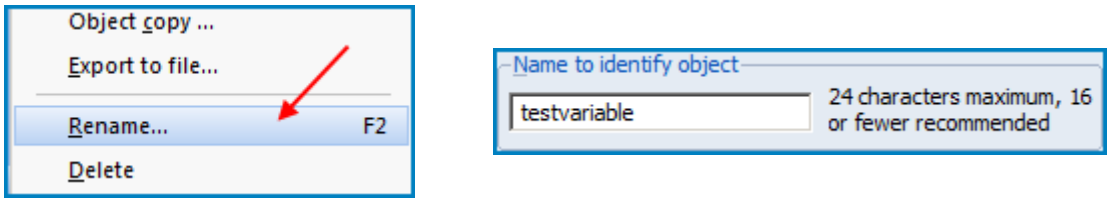
A spreadsheet opens in which you can enter new data. The default name for a new series is *SER01* that we will change. As you enter a number, press **Enter** to move to the next cell. You can add new data in as many columns as you like.



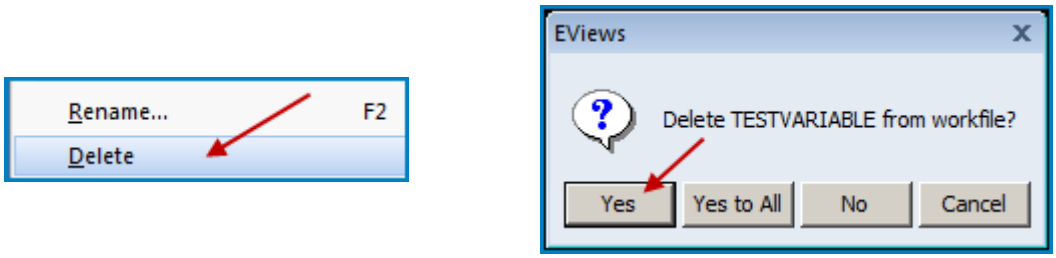
When you have finished entering the data you wish, click the **X** in the upper right corner of the active window. You will be asked if you want to "**Delete Untitled GROUP?**" Select **Yes**. In the workfile ***demo_ch1.wf1*** you will now find the new series labeled



To change this name, select the series (by clicking) then **right-click** in the shaded area. A box will open in which you can enter a new name for the "object," which in this case is a data series. Press **OK.**



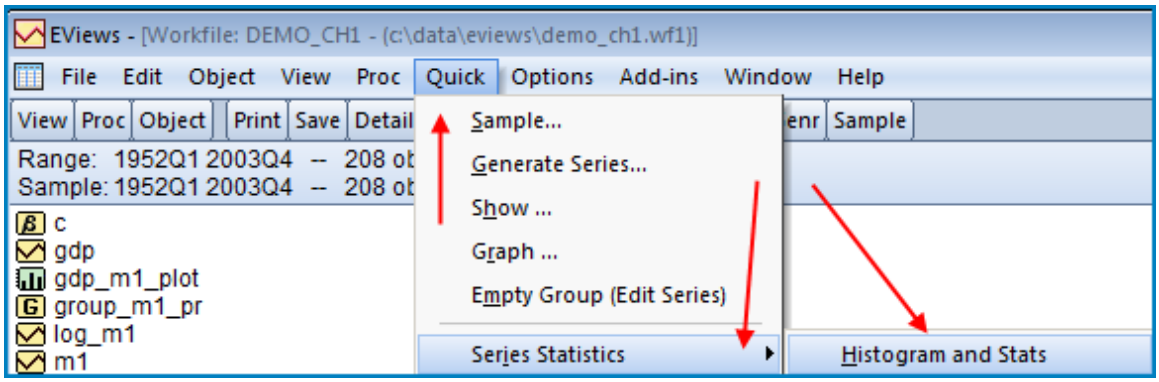
You can go through these same steps to delete an unwanted variable, such as the one we have just created. Select the series *TESTVARIABLE* in the workfile, and right-click. Select **Delete**. In the resulting window you will be asked to confirm the deletion. Select **Yes.**



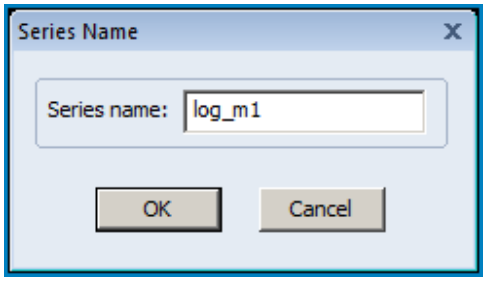
More than one series or objects can be selected for deletion by selecting one, then hold down the **Ctrl**-key while selecting others. To delete all these selected objects, **right-click** in the blue area, and repeat the steps above.

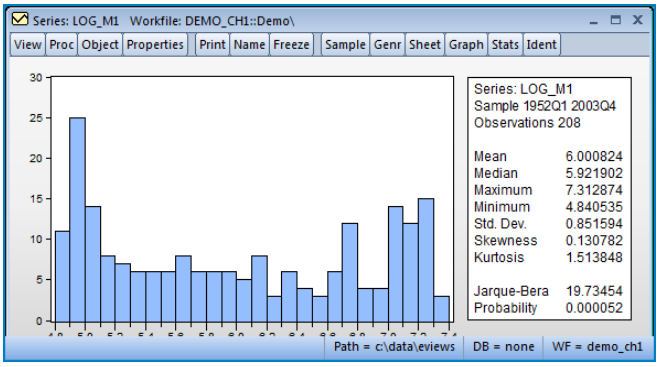
1.6.6 Quick/Series statistics

The next item on the EViews Quick menu is **Series Statistics**. Select **Quick/Series Statistics/Histogram and Stats:**



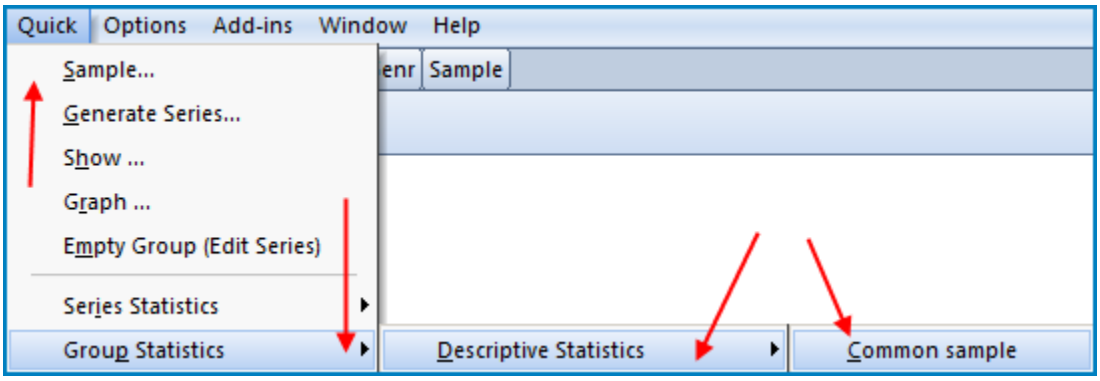
In the resulting window you can enter the name of the series (one) for which you desire the summary statistics. Then select **OK**.



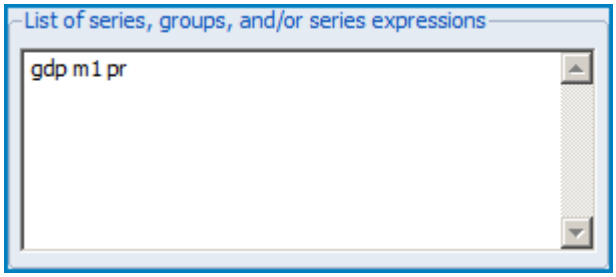


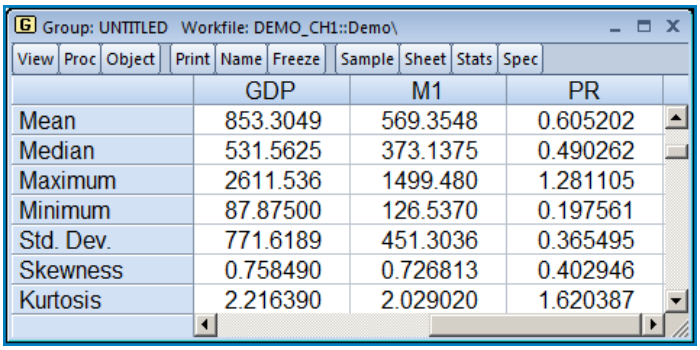
1.6.7 Quick/Group statistics

We can obtain summary statistics for a Group of series by choosing **Quick/Group Statistics**.



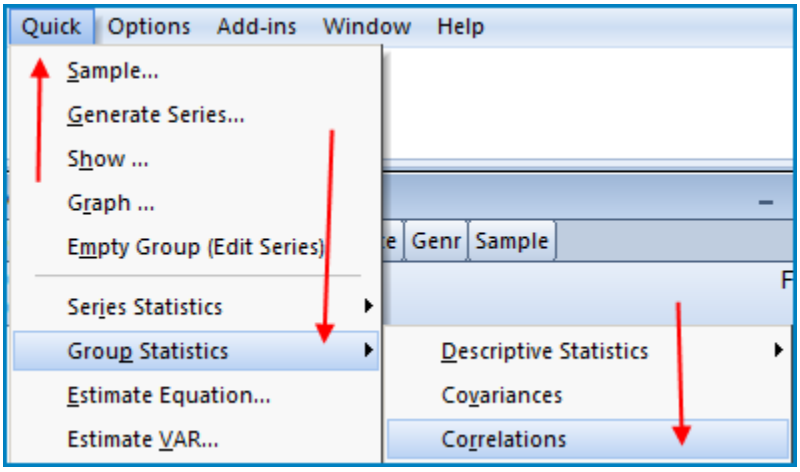
Enter the series names into the box and press **OK**. This will create the summary statistics table we have seen before. You can **Name** this group, or **Freeze** the table, or copy and paste using **Ctrl+C** and **Ctrl+V**.



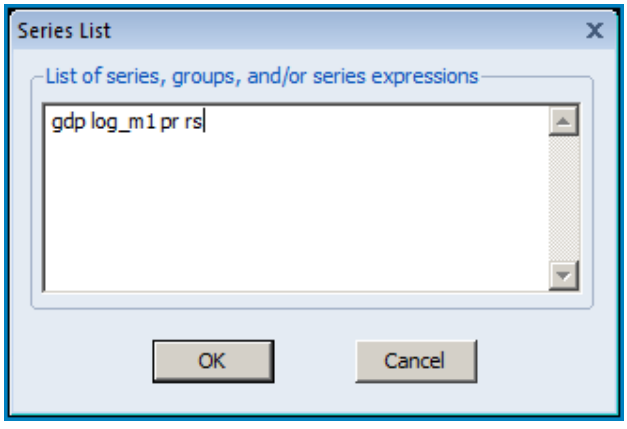


	GDP	M1	PR
Mean	853.3049	569.3548	0.605202
Median	531.5625	373.1375	0.490262
Maximum	2611.536	1499.480	1.281105
Minimum	87.87500	126.5370	0.197561
Std. Dev.	771.6189	451.3036	0.365495
Skewness	0.758490	0.726813	0.402946
Kurtosis	2.216390	2.029020	1.620387

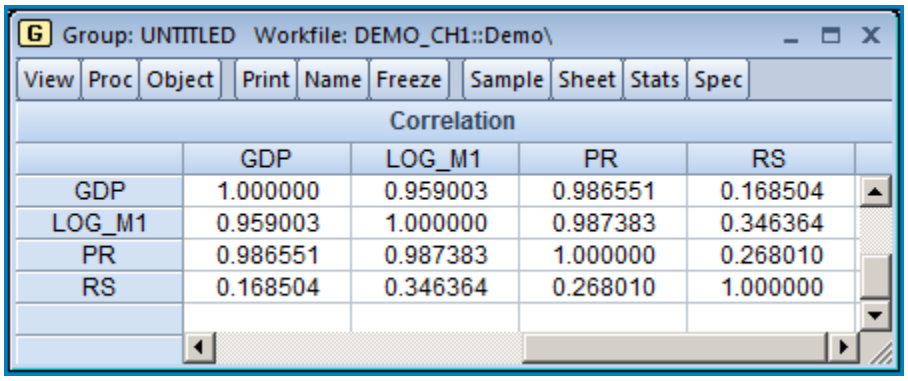
Another option under **Quick/Group Statistics** is **Correlations**.



Enter the names of series for which the sample correlations are desired and click **OK**.



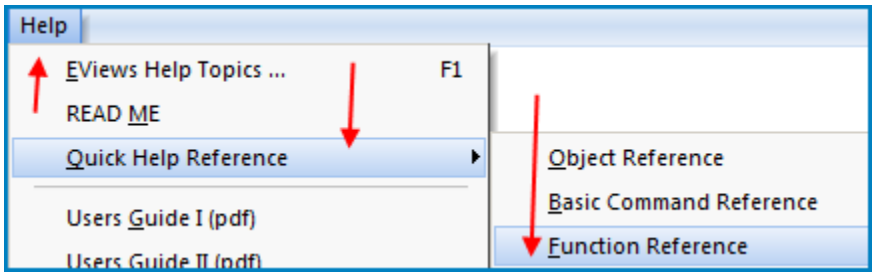
The sample correlations are arranged in an array, or matrix, format.



	GDP	LOG_M1	PR	RS
GDP	1.000000	0.959003	0.986551	0.168504
LOG_M1	0.959003	1.000000	0.987383	0.346364
PR	0.986551	0.987383	1.000000	0.268010
RS	0.168504	0.346364	0.268010	1.000000

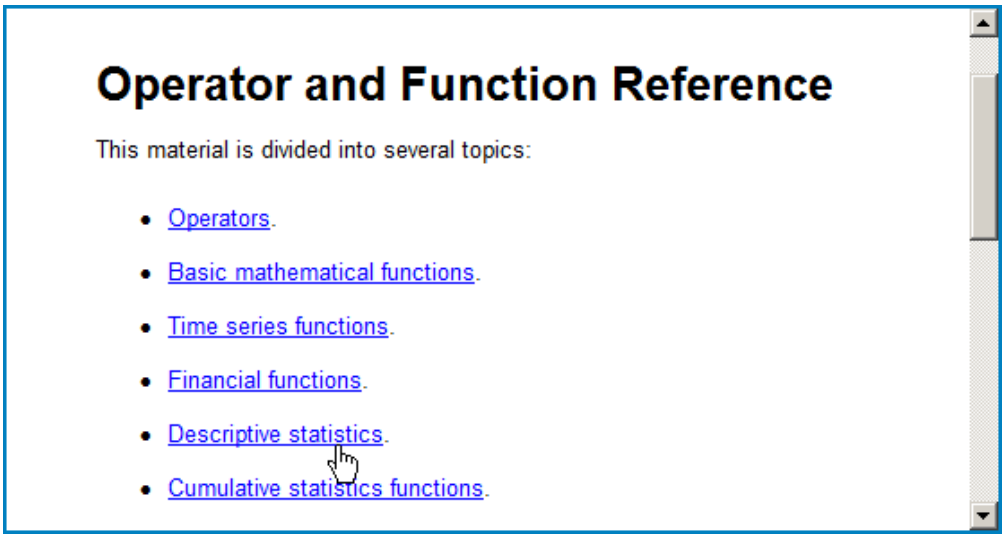
1.7 USING EVIEWS FUNCTIONS

Now we will explore the use of some EViews functions. Select **Help/Quick Help Reference/ Function Reference**.



1.7.1 Descriptive statistics functions

Select **Descriptive Statistics** from the list of material links.

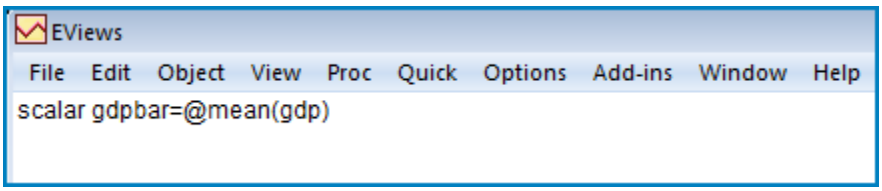


Some of the descriptive statistics functions listed there are on the next page.

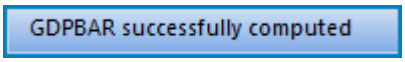
In this table of functions you will note that these functions begin with the "@" symbol. Also, these functions return a single number, which is called a **scalar**. In the commands the variables, or series, are called **x** and **y**. The bracket notation "[,s]" is optional and we will not use it. These functions are used by typing commands into the **Command window** and pressing **Enter**. For example, to compute the sample mean of *GDP*, type

```
scalar gdpbar = @mean(gdp)
```

The Command window looks like this.



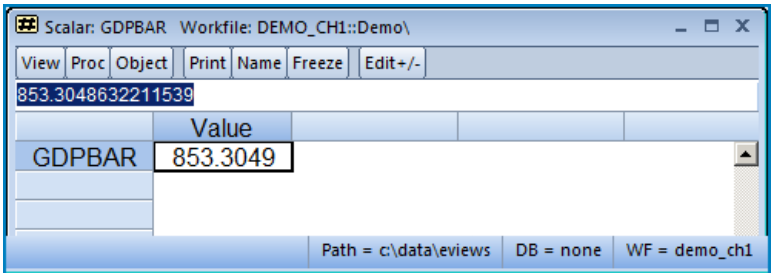
At the bottom of the EViews screen you will note the message



In the workfile window the new object is denoted with "#", which indicates a scalar.

We called the sample mean **GDPBAR** because sample means are often denoted by symbols like $\bar{x}$ which is pronounced "x-bar." In the "text-messaging" world in which you live, simple but meaningful names will occur to you naturally.

To view this scalar object double-click on it: it opens in a spreadsheet view.



The sample mean of *GDP* during the sample period is 853.305.

Scalars you have created can be used in further calculations. For example, enter the following commands by typing them into the Command window and pressing **Enter:**

```
scalar t = @obs(gdp)
scalar gdpse = @stdev(gdp)
scalar z = (gdpbar-800)/(gdpse/@sqrt(t))
```

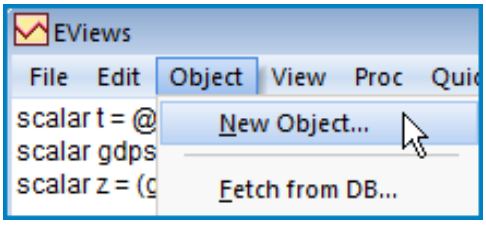
Selected Descriptive Statistics Functions in EViews 7.1

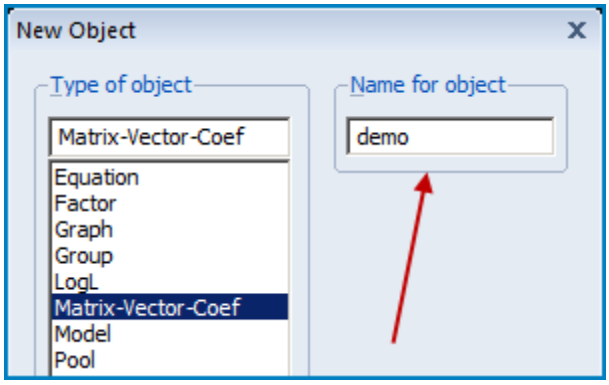
Function	Name	Description
`@cor(x,y[,s])`	correlation	the correlation between X and Y.
`@covs(x,y[,s])`	sample covariance	the covariance between X and Y (division by n−1).
`@inner(x,y[,s])`	inner product	the inner product of X and Y.
`@kurt(x[,s])`	kurtosis	kurtosis of values in X.
`@mae(x,y[,s])`	mean absolute error	the mean of the absolute value of the difference between X and Y.
`@mape(x,y[,s])`	mean absolute percentage error	100 multiplied by the mean of the absolute difference between X and Y, divided by Y.
`@max(x[,s])`	maximum	maximum of the values in X.
`@mean(x[,s])`	mean	average of the values in X.
`@median(x[,s])`	median	computes the median of the X (uses the average of middle two observations if the number of observations is even).
`@min(x[,s])`	minimum	minimum of the values in X.
`@prod(x[,s])`	product	the product of the elements of X (note this function is prone to numerical overflows).
`@obs(x[,s])`	number of observations	the number of non-missing observations for X in the current sample.
`@rmse(x,y[,s])`	root mean square error	the square root of the mean of the squared difference between X and Y.
`@skew(x[,s])`	skewness	skewness of values in X.
`@stdev(x[,s])`	standard deviation	square root of the unbiased sample variance (sum-of-squared residuals divided by n−1).
`@sum(x[,s])`	sum	the sum of X.
`@sumsq(x[,s])`	sum-of-squares	sum of the squares of X.
`@theil(x,y[,s])`	Theil inequality coefficient	the root mean square error divided by the sum of the square roots of the means of X squared and Y squared.
`@vars(x[,s])`	sample variance	sample variance of the values in X (division by n−1).

1.7.2 Using a storage vector

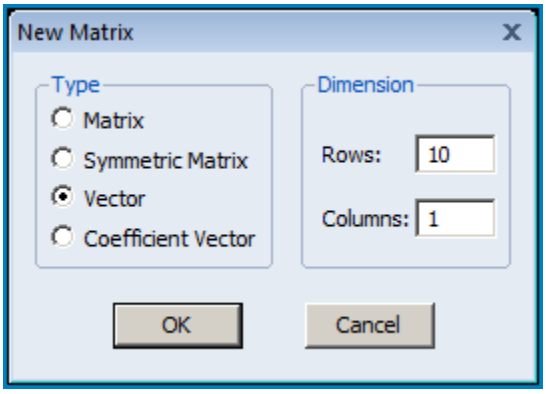
The creation of scalars leads to inclusion of additional objects into the workfile, and the scalars cannot be viewed simultaneously. One solution is to create a storage vector into which these scalars can be placed.

On the EViews menu bar select **Object/New Object**. In the resulting dialog box select **Matrix-Vector-Coef** and enter an object name, say **DEMO**. Click **OK**.





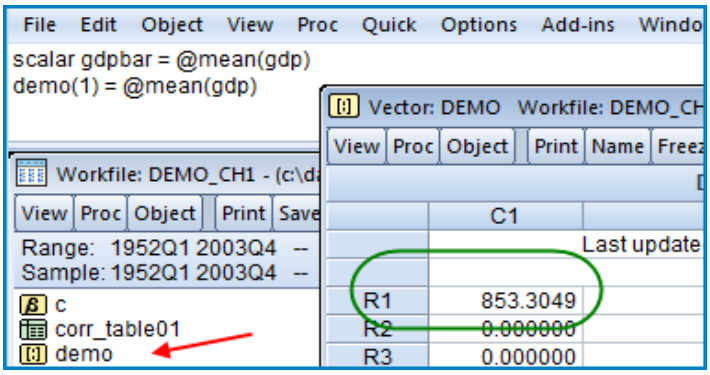
A dialog box will open asking what type of "new matrix" you want. To create a storage vector (an array) with 10 rows, select the radio button **Vector**, enter 10 for Rows, and click **OK**.



A spreadsheet will open with rows labeled R1 to R10. Now enter into the Command window the command

demo(1) = @mean(gdp)

When you press **Enter** the value in row R1 will change to 853.3049, the sample mean of GDP.

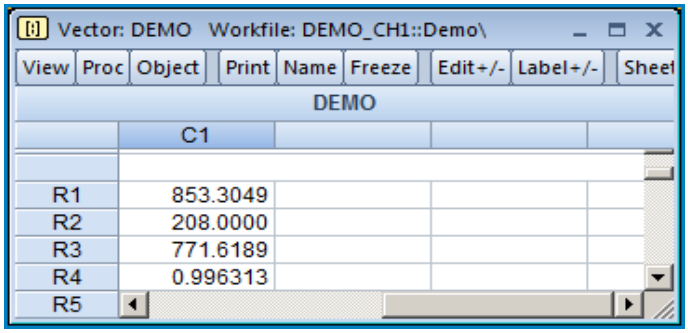


Now enter the series of commands, pressing **Enter** after each.

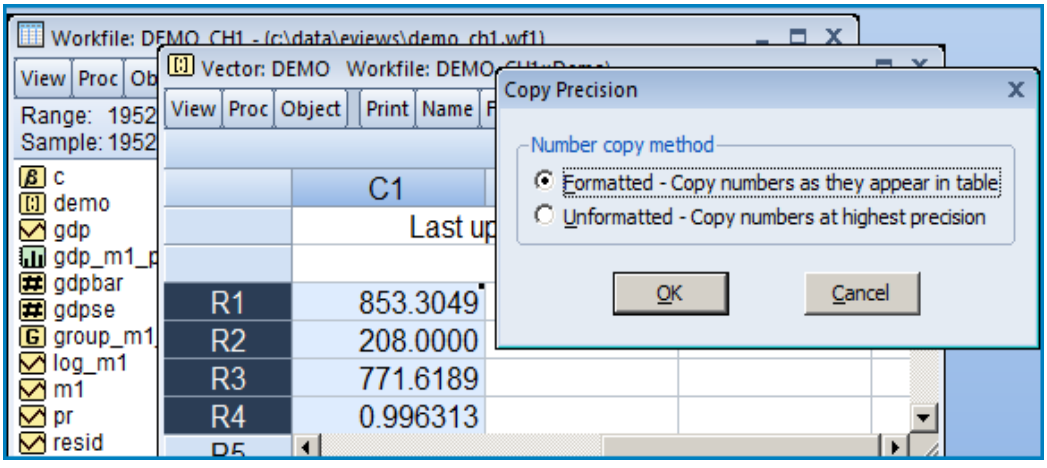
demo(2)=@obs(gdp)
demo(3)=@stdev(gdp)
demo(4)=(gdpbar-800)/(gdpse/@sqrt(t))

Each time a command is entered a new item shows in the vector. Note that in the last command could be included the previously calculated members of the vector **demo.** That is,

demo(4) = (@mean(gdp)-800) / (@demo(3)/@sqrt(demo(2)))



The advantage of this approach is that the contents of this table can be copied and pasted into a document for easy presentation. Highlight the contents, enter **Ctrl+C**. Choose the **Formatted** radio button and **OK**.



In an open document enter **Ctrl+V** to paste the table of results.

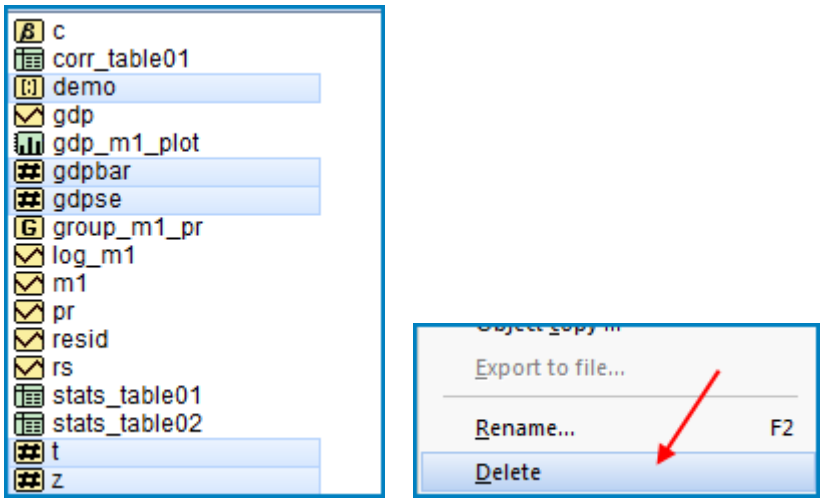
R1	853.3049
R2	208.0000
R3	771.6189
R4	0.996313

You can now edit as you would any table.

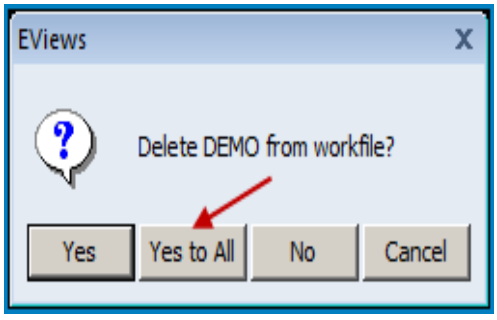
Demo vector	
GDP mean	853.3049
T sample size	208.0000
GDP Std Dev	771.6189
Z statistic	0.996313

We created many tables in the book *Principles of Econometrics* using this method.

To keep our workfile tidy, delete the scalar and vector objects that have no further use. Click the vector object **DEMO** and then while holding down the **Ctrl**-key, click on the scalars. Right-click in the blue-shaded area and select **Delete**.

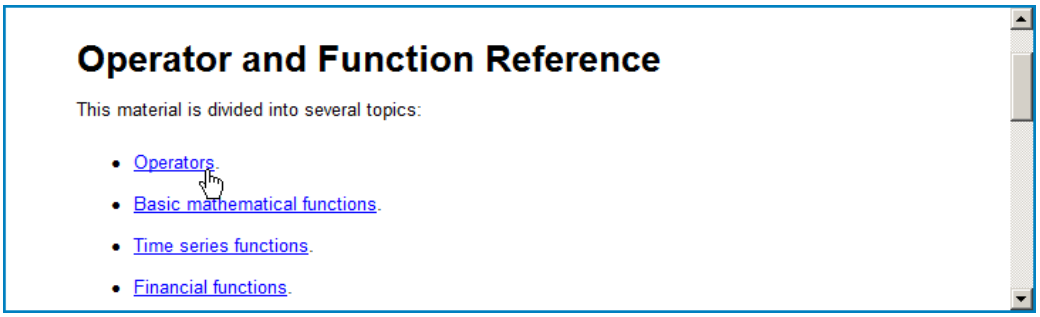


If you feel confident you can choose **Yes to All:**



1.7.3 Basic arithmetic operations

The basic arithmetic operations can be viewed at **Help/Quick Help Reference/Function Reference:**



The list of operators is given on the next page. These operators can be used when working with series, as in an operation to generate a new series, *RATIO1*, defined as 3 times the ratio of *GDP* to *M1*:

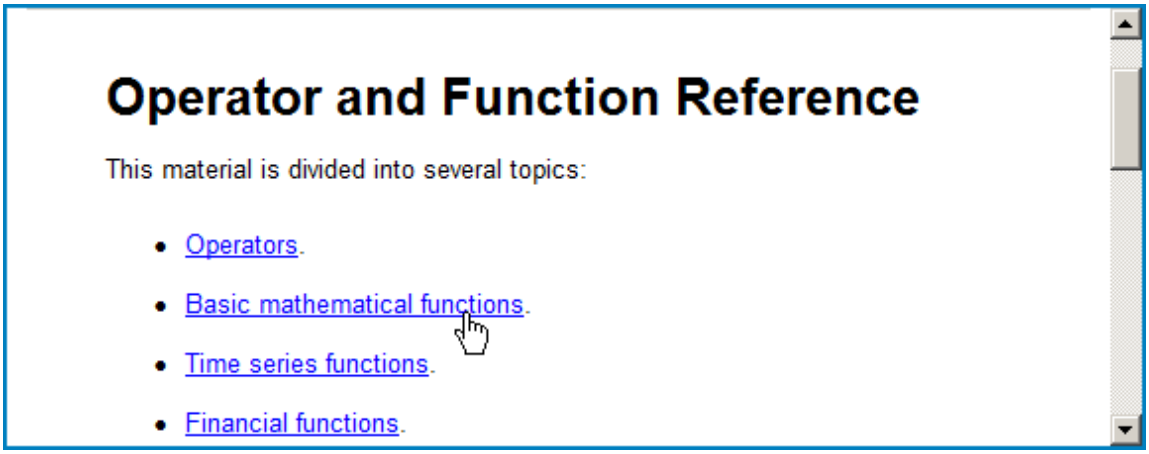
```
series ratio1 = 3*(gdp/m1)
```

Basic Arithmetic Operations

Expression	Operator	Description
+	add	x+y adds the contents of X and Y.
–	subtract	x-y subtracts the contents of Y from X.
*	multiply	x*y multiplies the contents of X by Y.
/	divide	x/y divides the contents of X by Y.
^	raise to the power	x^y raises X to the power of Y.
>	greater than	x>y takes the value 1 if X exceeds Y, and 0 otherwise.
<	less than	x<y takes the value 1 if Y exceeds X, and 0 otherwise.
=	equal to	x=y takes the value 1 if X and Y are equal, and 0 otherwise.
<>	not equal to	x<>y takes the value 1 if X and Y are not equal, and 0 if they are equal.
<=	less than or equal to	x<=y takes the value 1 if X does not exceed Y, and 0 otherwise.
>=	greater than or equal to	x>=y takes the value 1 if Y does not exceed X, and 0 otherwise.

1.7.4 Basic math functions

The basic math functions can be viewed at **Help/Quick Help Reference/Function Reference.**



Some of these functions are listed below. Note that common ones like the absolute value (**abs**), the exponential function (**exp**), the natural logarithm (**log**), and the square root (**sqr**) can be used with or without the @ sign.

Selected Basic Math Functions

Name	Function	Examples/Description
`@abs(x), abs(x)`	absolute value	@abs(-3)=3.
`@exp(x), exp(x)`	exponential, e^x	@exp(1)=2.71813.
`@fact(x)`	factorial, *x*!	@fact(3)=6, @fact(0)=1.
`@inv(x)`	reciprocal, 1/x	inv(2)=0.5.
`@mod(x,y)`	floating-point remainder	returns the remainder of x/y with the same sign as x. If y=0 the result is 0.
`@log(x), log(x)`	natural logarithm, $\log_e(x)$	@log(2)=0.693..., log(@exp(1))=1.
`@round(x)`	round to the nearest integer	@round(-97.5)=-98, @round(3.5)=4.
`@sqrt(x), sqr(x)`	square root	@sqrt(9)=3.

1.8 CREATING WORKFILES

If you are fortunate enough to have your data in the form of an EViews workfile, then you can simply open that file and proceed with the various commands that we describe in the following chapters. The EViews workfile can be opened in one of three ways: (1) by using **File/Open/ Workfile** as described in Section 4.1.1, (2) by double-clicking the icon of the file name, or (3) by selecting the file and, holding the left-mouse button, dragging it to the EViews icon on the desktop.

Suppose, however, that you need to collect your data, and the data are available in another format, such as an Excel file or a text file. How do you create an EViews workfile that contains the required data? We begin to answer this question by exploring how to download data from the Internet into an Excel file; then we examine ways of creating an EViews workfile from an Excel file or a text file.

1.8.1 Obtaining data from the Internet

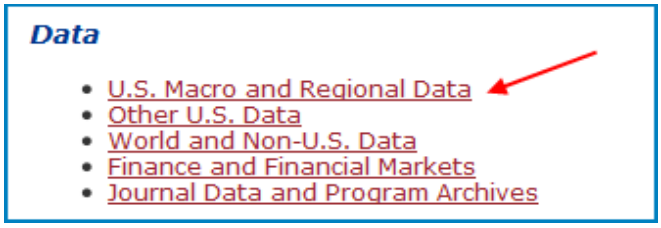
Getting data for economic research is much easier today than it was years ago. Before the Internet, hours would be spent in libraries, looking for and copying data by hand. Now we have access to rich data sources that are a few clicks away.

Suppose you are interested in analyzing the GDP of the United States. As suggested in *POE4*, the website **Resources for Economists** contains a wide variety of data, and in particular the macro data we seek.

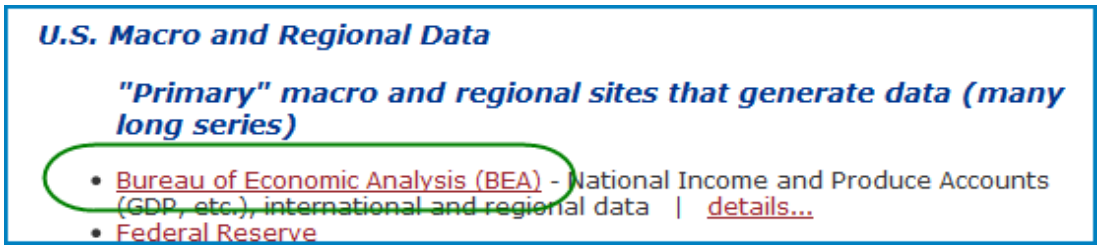
Websites are continually updated and improved. We will guide you through an example, but be prepared for differences from what we show here.

First, open up the website: http://www.aeaweb.org/rfe/:

Select the **Data** option, and then select **U.S. Macro and Regional Data**.

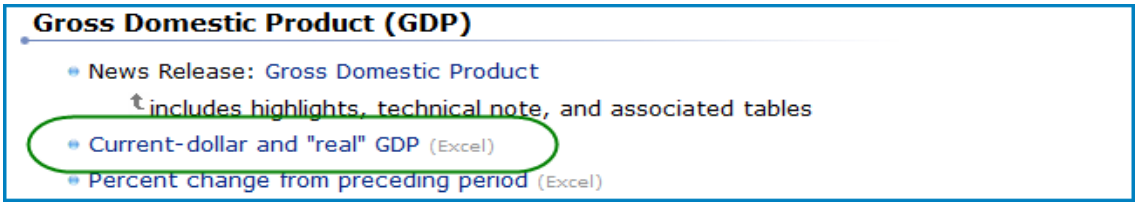


This will open up a range of sub-data categories. For the example considered here, select the **Bureau of Economic Analysis (BEA)-National Income and Produce Accounts** to get data on GDP.

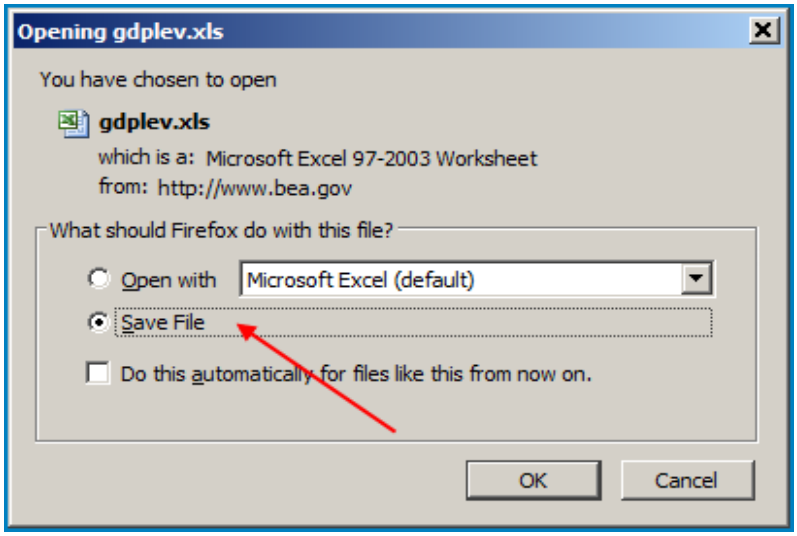


From the screen below, select the **Gross Domestic Product** option.

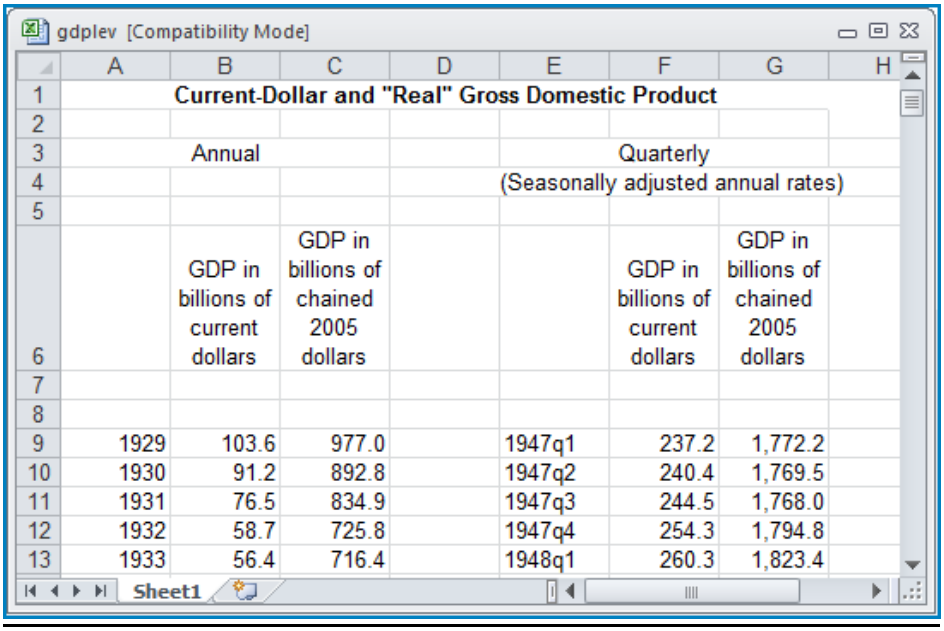
Most websites allow you to download data conveniently in Excel format.



Select the Excel option and a dialog box will open. **Save** the data as ***gdplev.xls***.



Once the file has been downloaded we can open the file; a sample of the data in Excel format is shown below.



gdplev [Compatibility Mode]

	A	B	C	D	E	F	G	H
1	Current-Dollar and "Real" Gross Domestic Product							
2								
3		Annual				Quarterly		
4						(Seasonally adjusted annual rates)		
5								
6		GDP in billions of current dollars	GDP in billions of chained 2005 dollars			GDP in billions of current dollars	GDP in billions of chained 2005 dollars	
7								
8								
9	1929	103.6	977.0		1947q1	237.2	1,772.2	
10	1930	91.2	892.8		1947q2	240.4	1,769.5	
11	1931	76.5	834.9		1947q3	244.5	1,768.0	
12	1932	58.7	725.8		1947q4	254.3	1,794.8	
13	1933	56.4	716.4		1948q1	260.3	1,823.4	

Sheet1

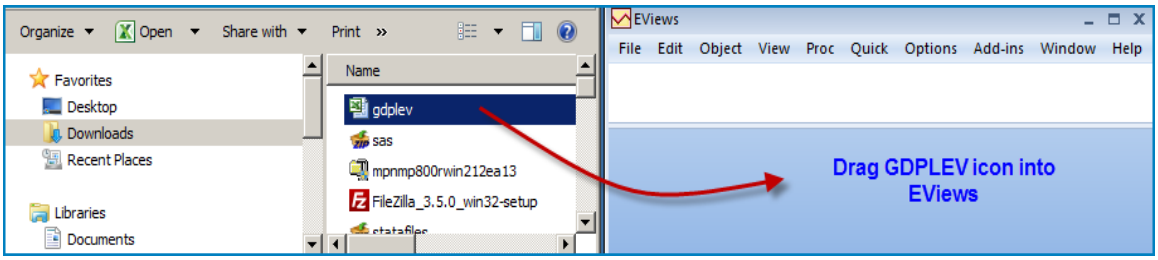
Let us now create the desired EViews file by importing the annual data (1929-2010) for nominal GDP (column B, first observation in cell B9) and real GDP (column C, first observation in cell C9) into an EViews workfile.

1.8.2 Importing an Excel file: drag and drop

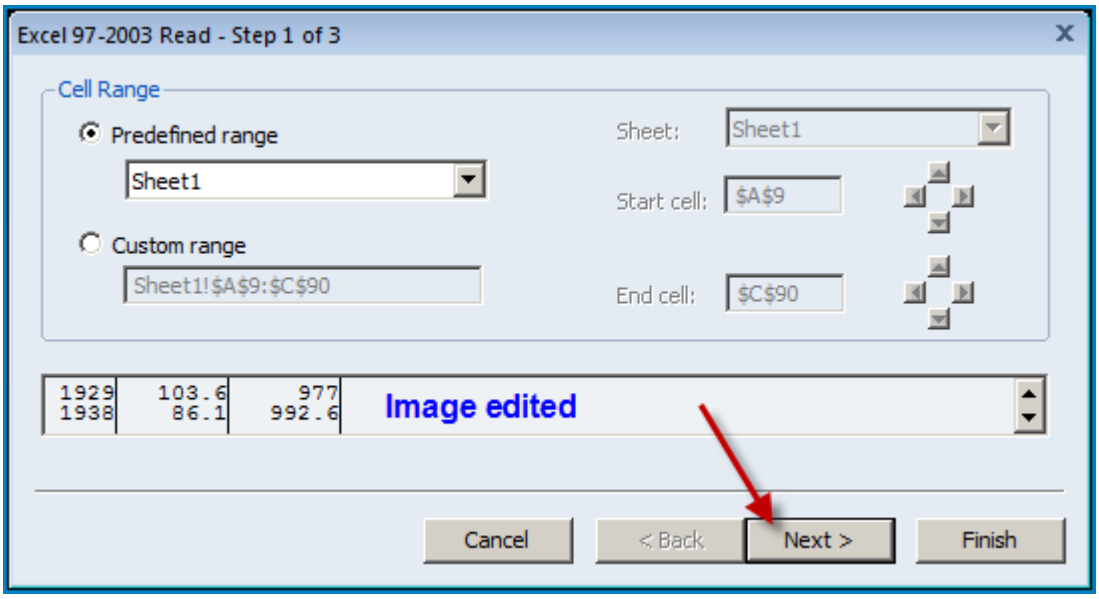
EViews makes it very easy to import data from a variety of formats. For example, Excel 97-2003 and text (ASCII) files can be imported by "dragging and dropping."

Remark: EViews imports Excel 97-2003 files, ending in ****.xls***, with no difficultly. If, however, you have a newer Excel file, ending in ****.xlsx***, then you may have problems. The solution is to open the ****.xlsx*** file and save it under the older format before importing.

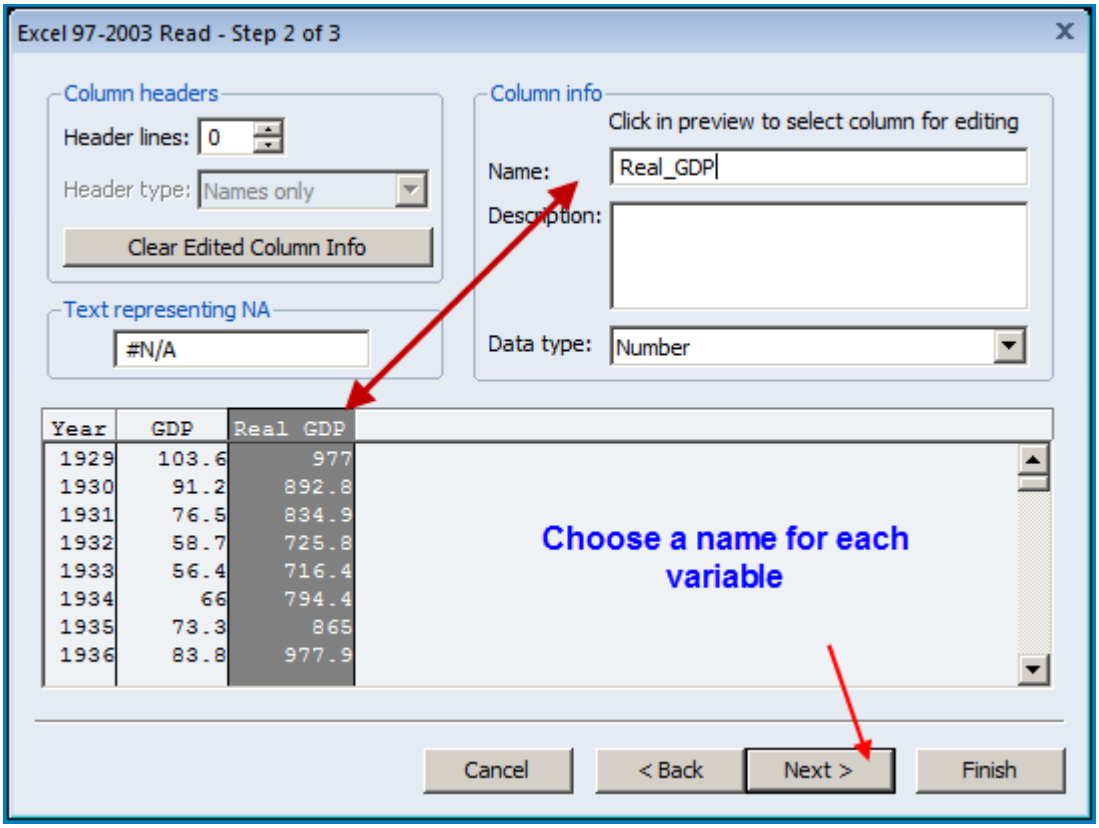
Highlight the file to be imported and hold down the left-mouse button. If EViews is open, drag the file icon into EViews as shown below. If EViews is not open, you can drag the file icon onto the EViews icon on the desktop.



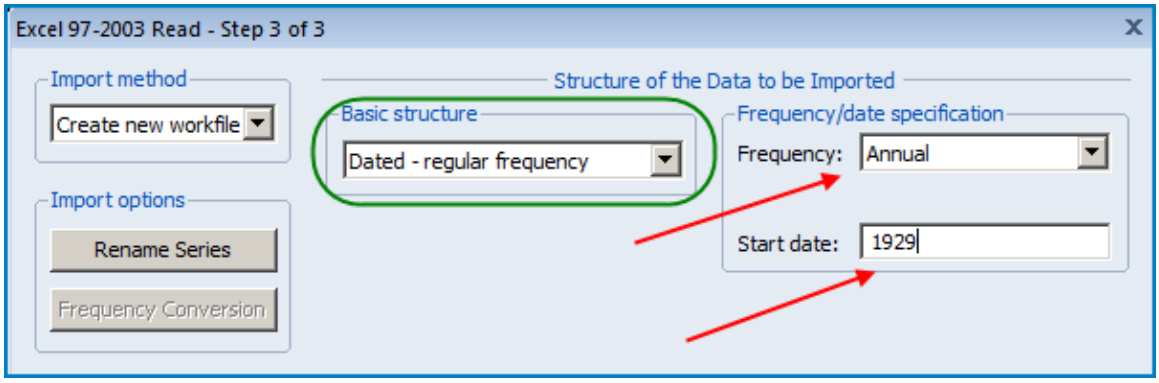
Then there will be a series of confirmatory screens. Usually the default settings are fine and we just click **Next.** In the screen shot below we have edited the image a bit, cutting out some of the data lines to make it smaller.



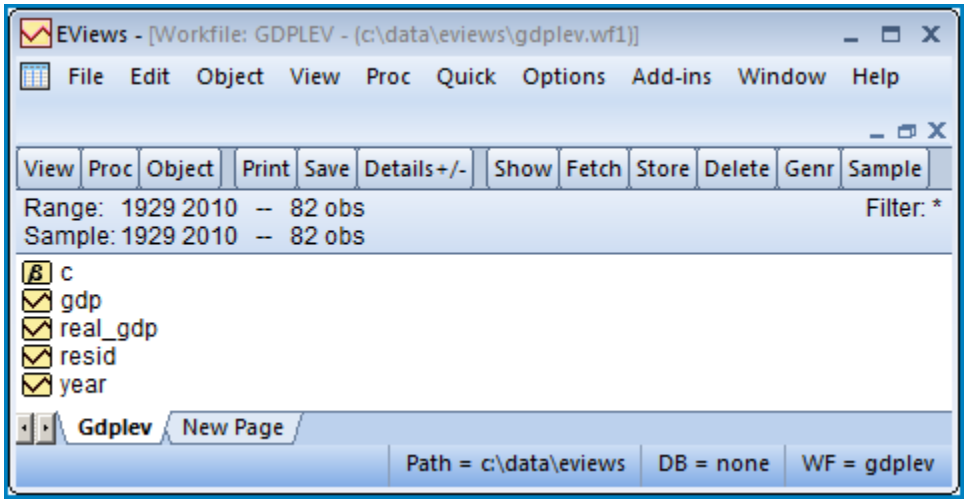
In Step 2 we have an opportunity to give the series names.



In Step 3 we can define the basic structure of the workfile, which in this case is **Dated** with a **regular annual frequency**, with the **start date** of 1929.



Click **Finish** and there you have it.

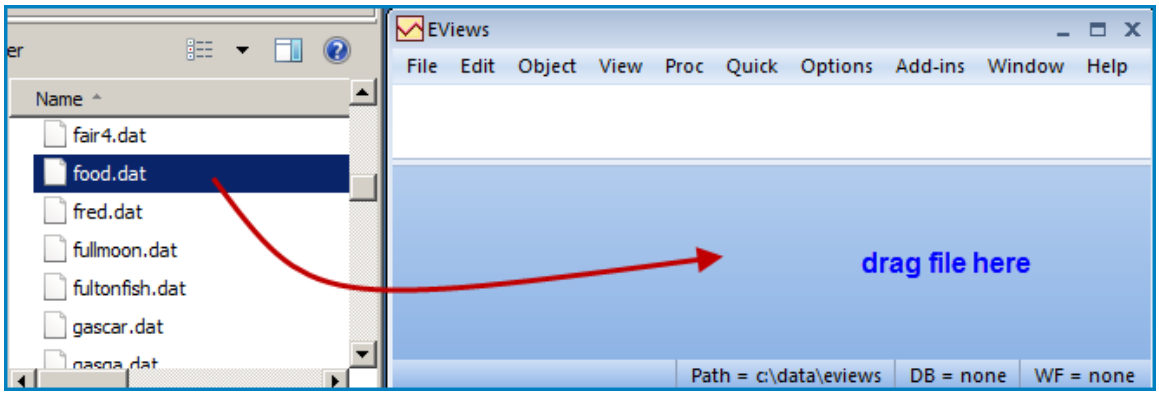


1.8.3 Importing a text data file: drag and drop

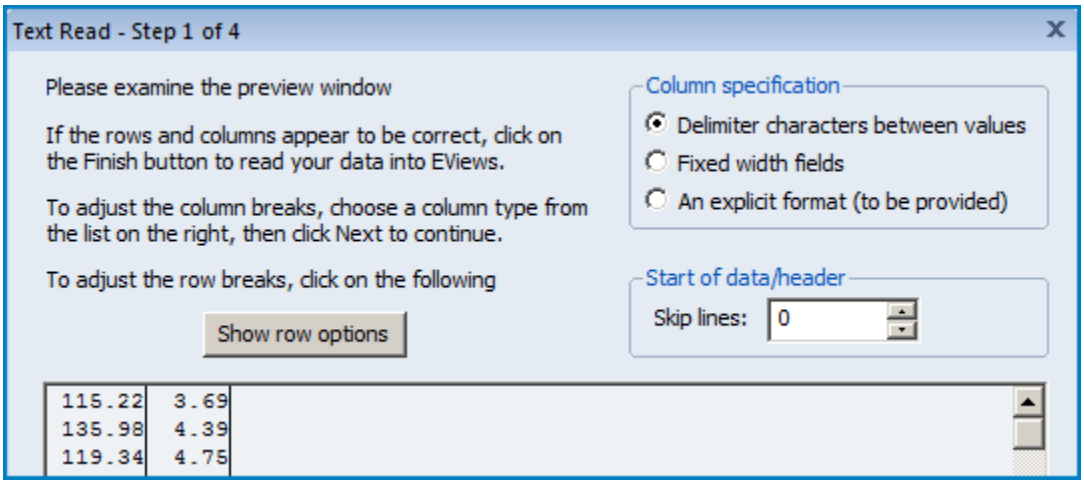
EViews supports the "drag-and-drop" approach for a number of different software formats. Let's give it a try using an ASCII, or text format, data file. The data files for *POE4* in text format are located at http://www.principlesofeconometrics.com/poe4/poe4dat.htm. These files have a *.dat extension. We will use ***food.dat***. The first few observations are:

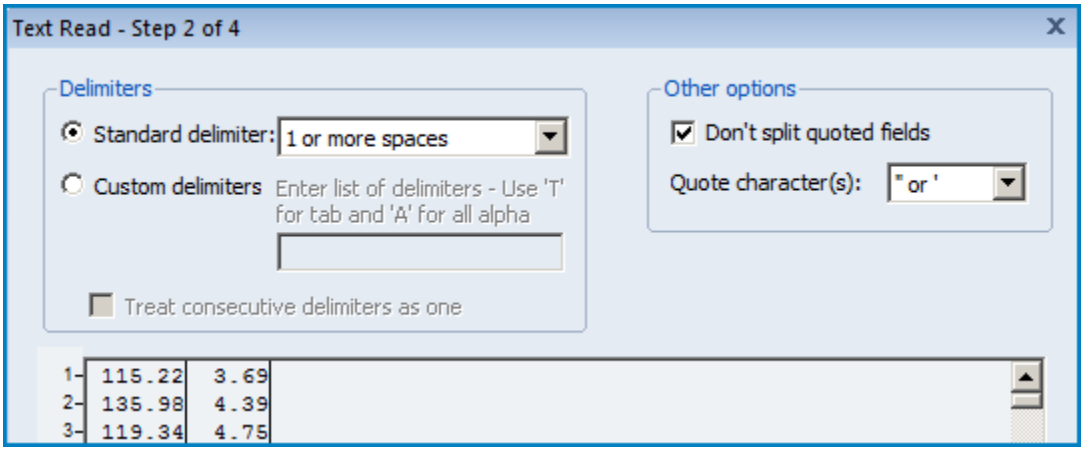
```
115.22       3.69
135.98       4.39
119.34       4.75
114.96       6.03
187.05      12.47
```

Download the file from the internet, and then drag it into EViews or onto the EViews icon on the desktop. Select the file, then holding the left-mouse button, slide the mouse.

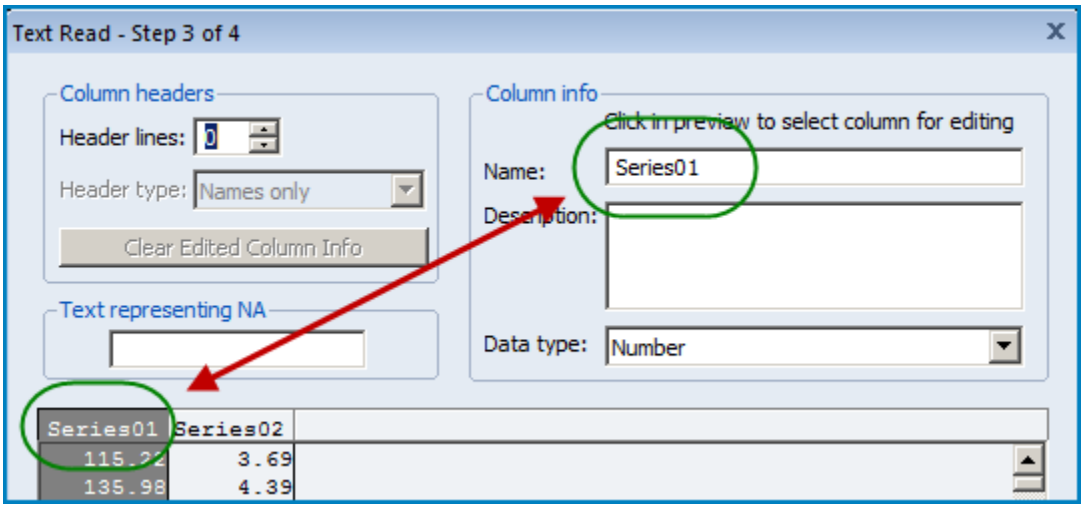


We then have a series of screens checking if the data match your expectations. In each, if all looks good, click **Next**.

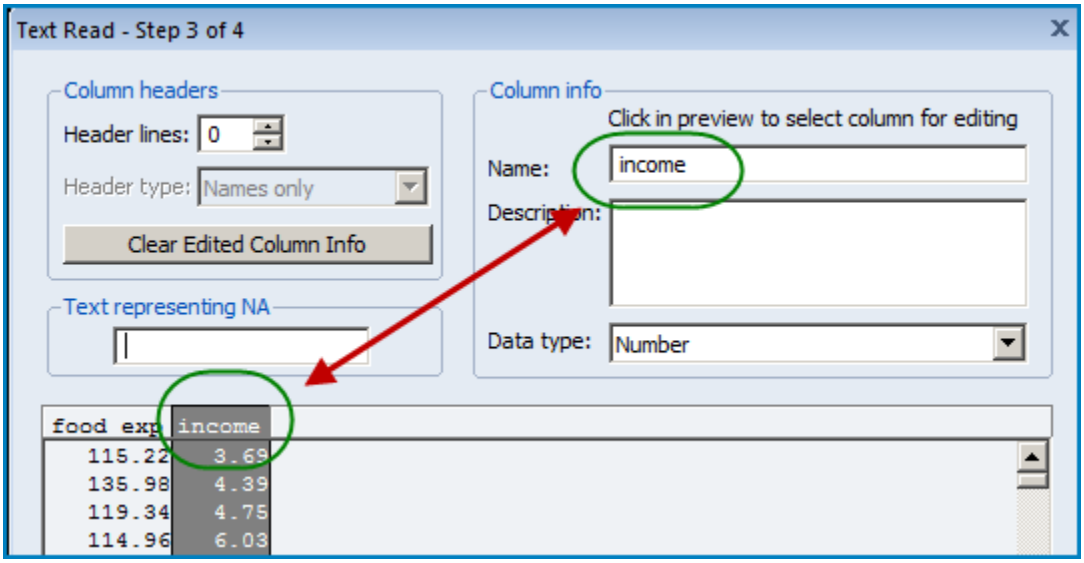




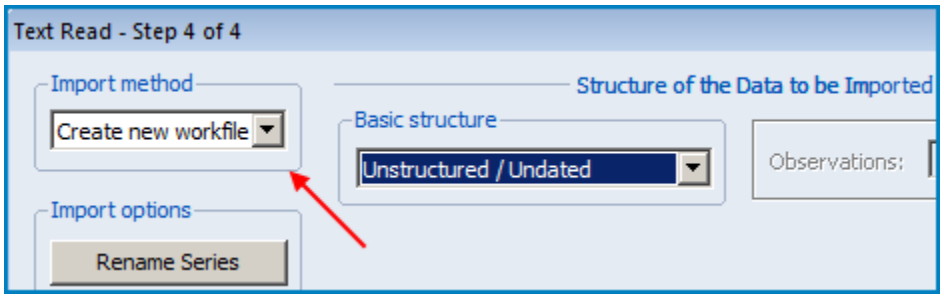
In Step 3 we can change the default names of each column.



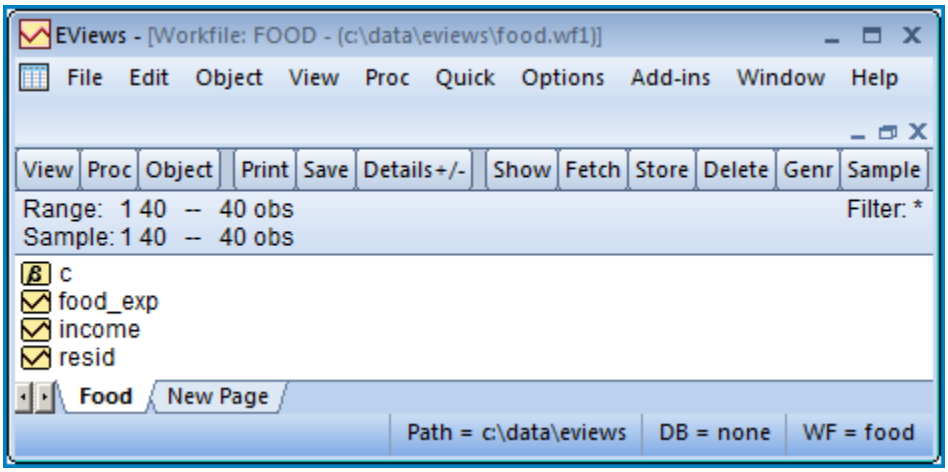
As you select each column, enter a name for that series, then highlight the next column and repeat.



In the final step we **Create new workfile**.



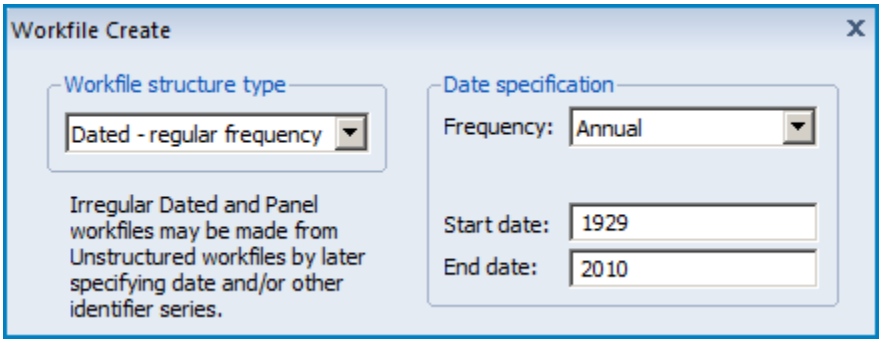
Select **Finish**. And there you have it.



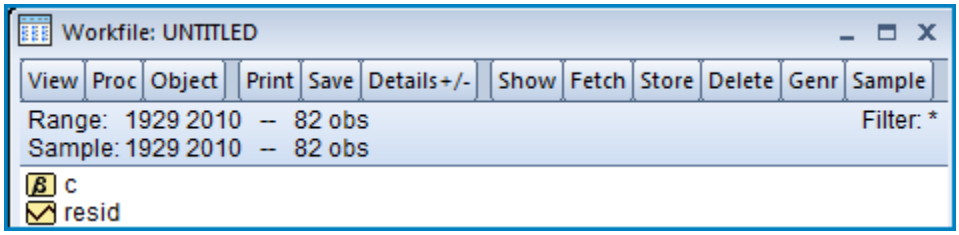
1.8.4 Importing an Excel data file using Proc/Import

Dragging and dropping is the easiest way to create an EViews workfile with data imported from another source. However, there is a longer way where you first open EViews and then use commands for importing data. In this and the next section we describe this process for Excel and text files.

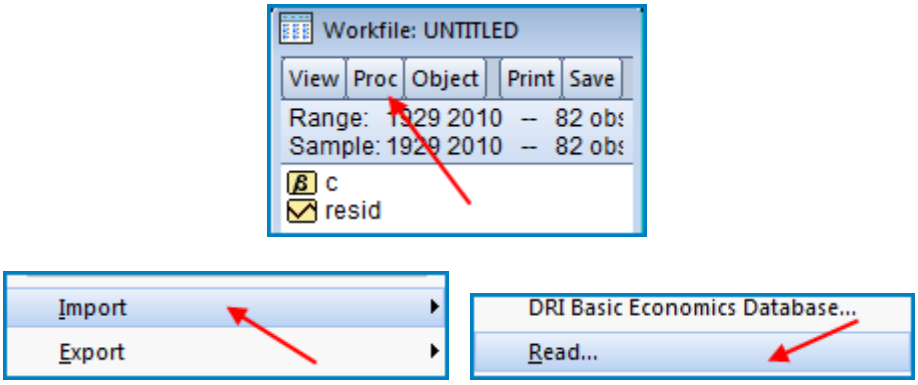
To create an EViews workfile, double click on your EViews icon to open the software, then select **File/New/Workfile**. The following screen will open:



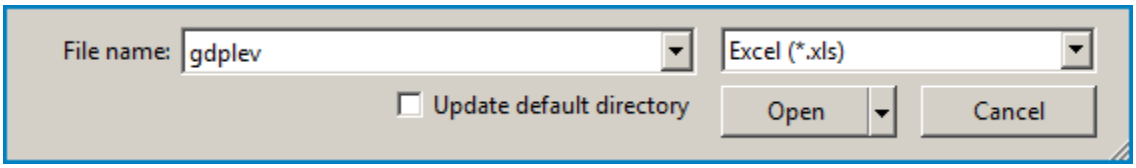
To create the workfile for annual data covering sample period **1929** to **2010**, select **Annual** from the drop-down menu in **Frequency** and type in the **Start** and **End dates**. Clicking on **OK** will create the **UNTITLED** workfile below.



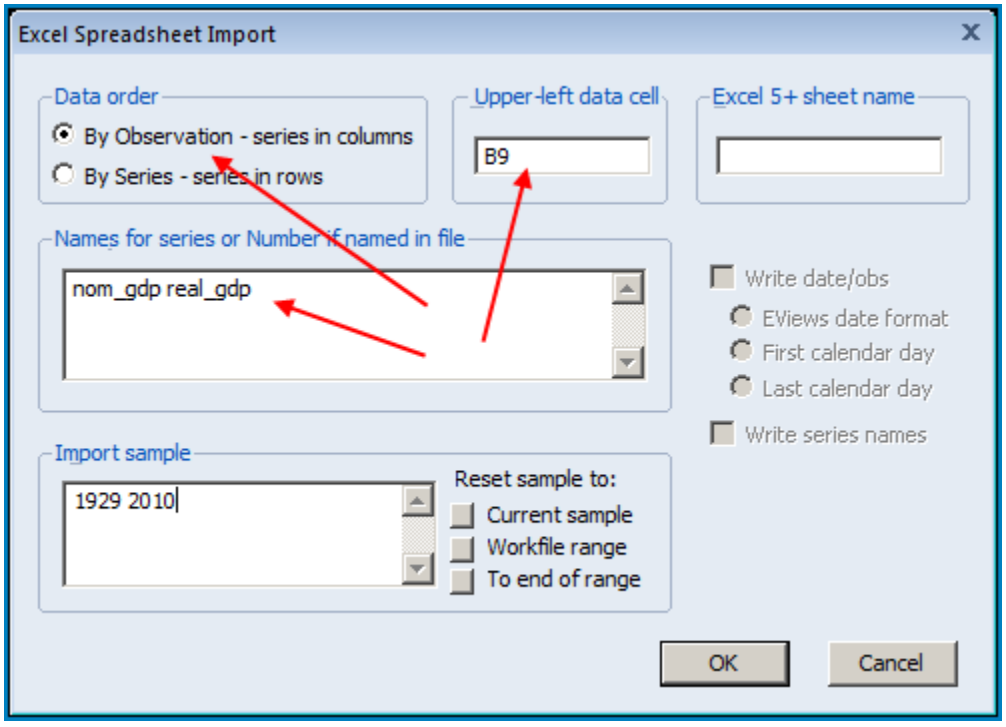
To import data select **Proc/Import/Read**.



EViews will then ask you for the location of the Excel file. Open the ***gdpplev.xls*** file we have created:



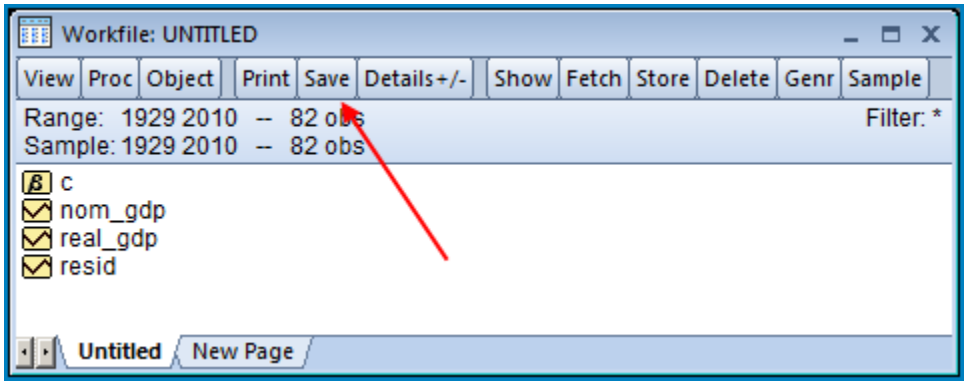
and the following screen will open:



Be sure to pick the **By observation – series in columns** option, enter the correct location of the first observation (**B9**) and type in the names of the variables – in this case *NOM_GDP* and *REAL_GDP*. Clicking on **OK** will import the data from the Excel datafile to the EViews workfile. As a check, open the group *NOM_GDP* and *REAL_GDP* and you can see that we have successfully imported the data (do check this against the Excel spreadsheet shown above).

obs	NOM_GDP	REAL_GDP
1929	103.6000	977.0000
1930	91.20000	892.8000
1931	76.50000	834.9000
1932	58.70000	725.8000
1933	56.40000	716.4000
1934	66.00000	794.4000
1935	73.30000	865.0000

The final step is to **save** your workfile.



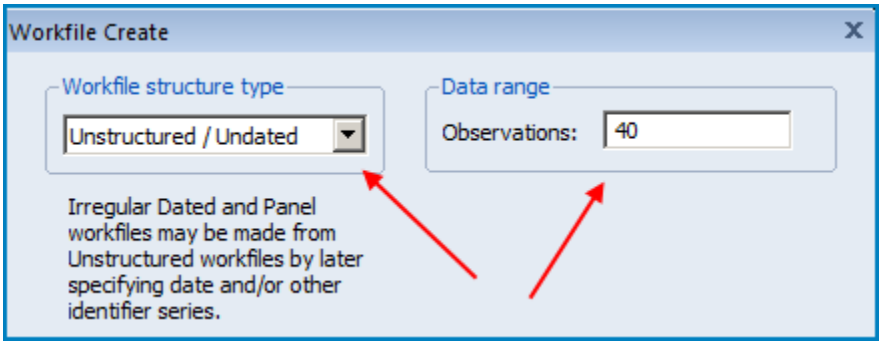
1.8.5 Importing a text data file using Proc/Import

Excel data files are a common way of handling data. However, some data also come in text form and so, for completeness, we shall consider the case of importing a text data file. As an illustration we will import an ASCII file called ***food.dat***. Before trying to import the data in ***food.dat***, examine the contents of the definition file ***food.def***. It is an ASCII file that can be opened with NOTEPAD. The ****.def*** files contain variable names and descriptions. For example, open ***food.def***.

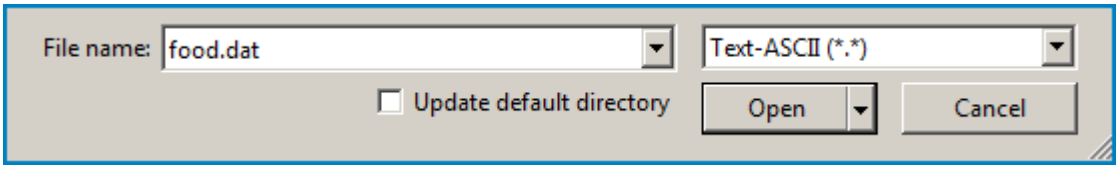
```
food.def

food_exp income

  obs:   40

  1. food_exp (y)                  weekly food expenditure in $
  2. income   (x)                  weekly income in $100


    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
    food_exp |        40    283.5735    112.6752      109.71     587.66
      income |        40    19.60475    6.847773        3.69       33.4
```

This definition file shows that there are 40 observations on two variables, *FOOD_EXP* and *INCOME*, in that order, and they are weekly food expenditure and weekly income, respectively.

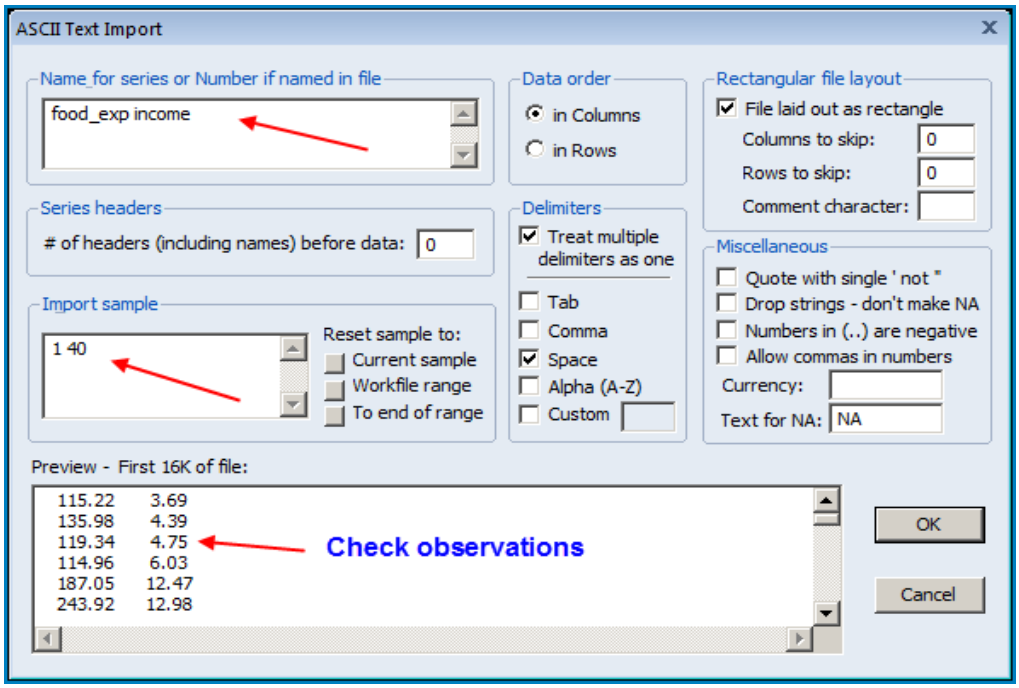
To import this data, create a workfile for 40 undated observations and click **OK**. Select **File/New/Workfile** on the EViews menu.



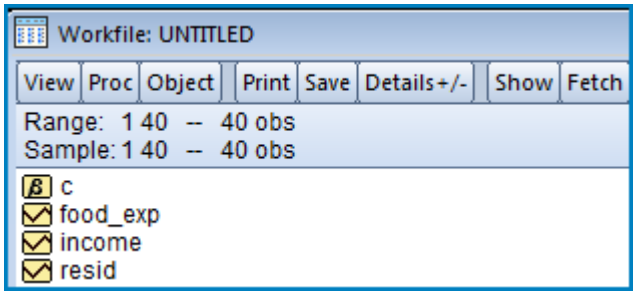
Click **Proc/Import/Read** as in the previous section, and navigate to the file ***food.dat***.



Select **Open**. A dialog box will open. And at the bottom of the dialog box, we can see the first few observations in the data file. Because the data file does not contain variable names, enter them as shown, and click **OK**.



Two new series have been added, *FOOD_EXP* and *INCOME*. **Save** your file.

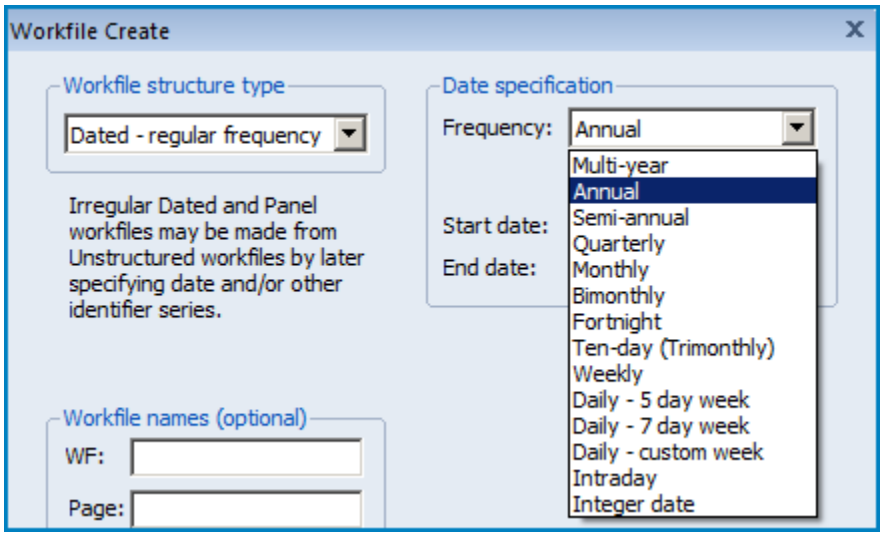


1.8.6 Adding data to an existing workfile

If you have an existing workfile containing some data, but you would like to add more data to it, you can use either the drag and drop method or the **Proc/Import** method. The procedures described in the last four sections can be used in a similar way.

1.8.7 Frequency conversions

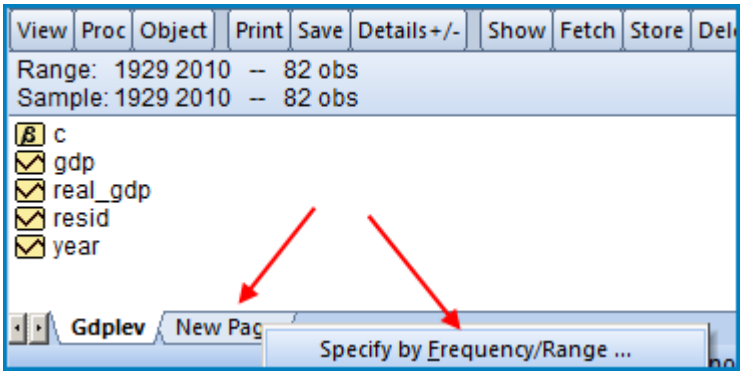
EViews offers a range of frequencies – annual, quarterly, monthly and so on.



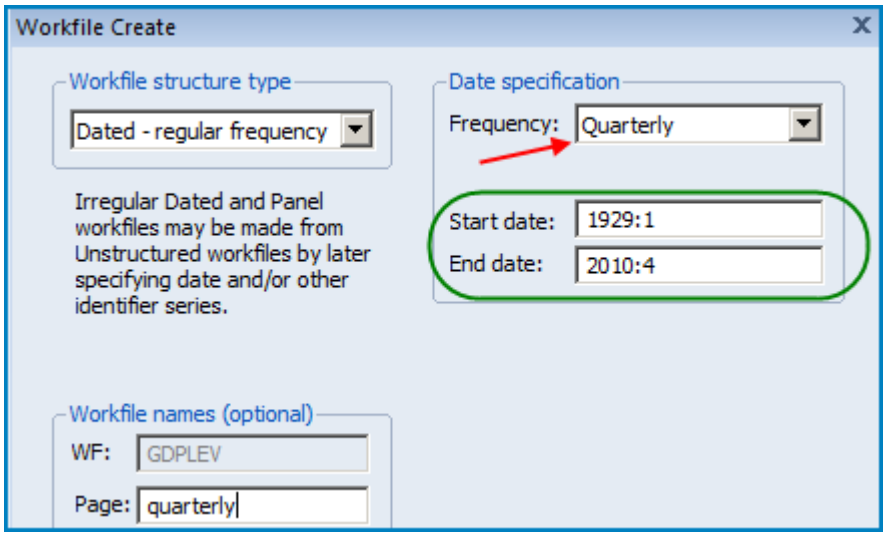
Examples of data conventions include:

- Annual: specify the year; for example, 1981, or 2007.
- Quarterly: the year, followed by a number or the quarter. Examples: 2007:3, 2007Q3.
- Monthly: the year, followed by a number or the month. Examples: 1956:11, 1956M11.
- Weekly and daily: by default, you should specify these dates as Month/Day/Year. Thus August 15, 2007 is 8/15/2007.

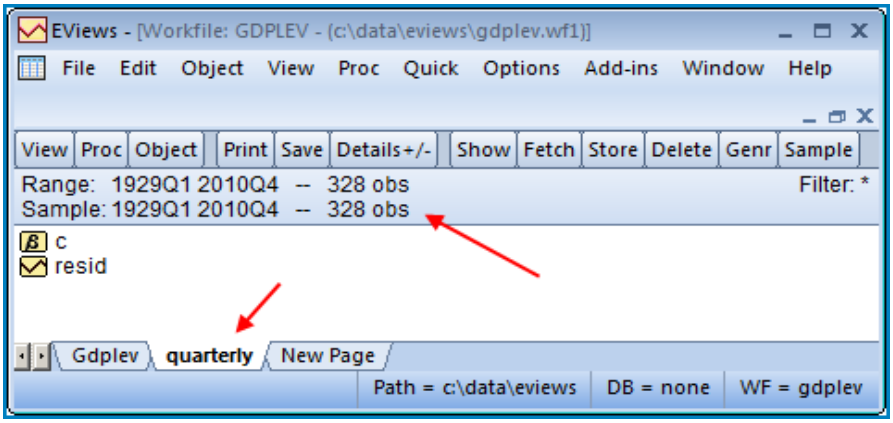
EViews also offers an easy way to convert from one frequency to another. Suppose we are interested in converting the annual data on GDP to their quarterly equivalents. To do so, first click on **New Page** and select **Specify by Frequency/Range**.



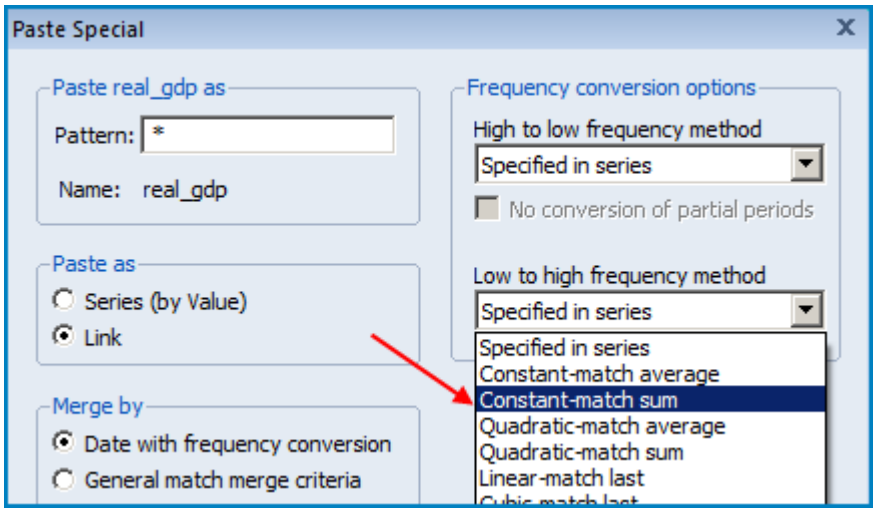
Specify the range of the quarterly data as shown.



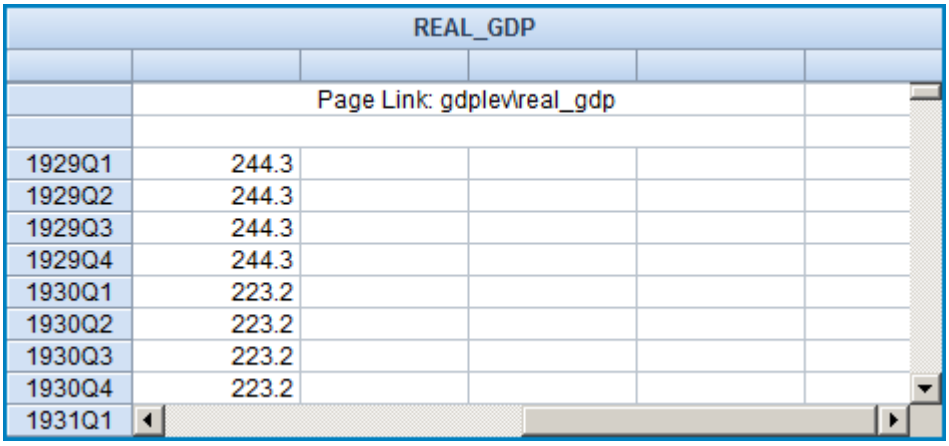
Click **OK.** The following page will open. You might like to name this page too.



To transfer data from one frequency to another, just **right-click** on the variable on the page with the annual frequency (say *REAL_GDP*) and drag that to the bottom of the page set up for quarterly data. The screen below will open.

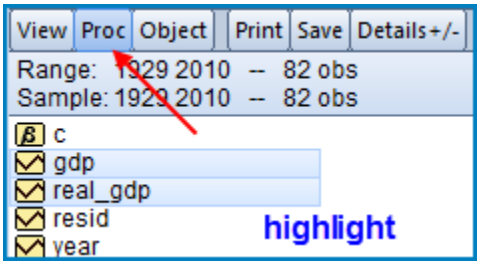


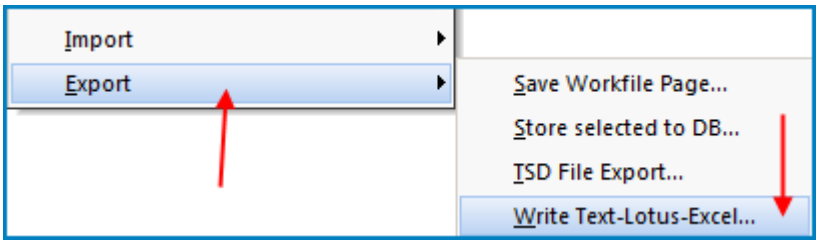
We are converting from a low to a high frequency, and in this example we are selecting the **constant-match sum** option. Clicking **OK** will create the new variable. For comparison, open the two series and you will note that the quarterly data is one-fourth of the annual.



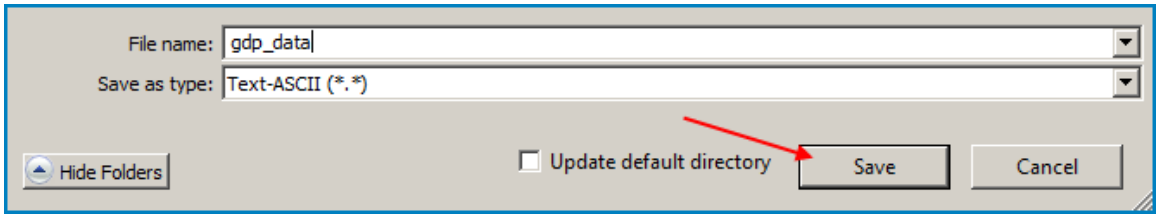
1.8.8 Exporting data from EViews

There are times when you would like to export data from an EViews workfile. To illustrate, let us work with ***gdplev.wf1*** and export the two series. To do so, highlight the two series, then click on **Proc/Export/Write Text-Lotus-Excel.**

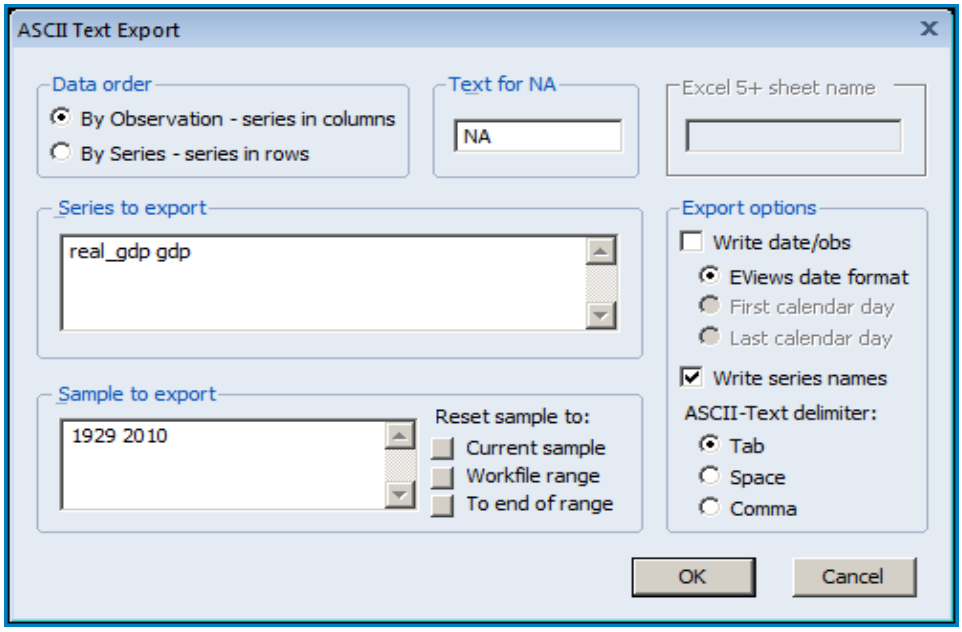




This will then open a window with the option to save as a text or Excel file.



In the resulting screen you will have some choices concerning formats and delimiters.



Keywords

arithmetic operators
basic graph
close series
copying a table
copying graph
Generate Series
Genr
graph metafile
graph options
Group: empty
Quick/Generate Series
Quick/Graph
Quick/Group Statistics
Quick/Sample
Quick/Series Statistics

CHAPTER 2

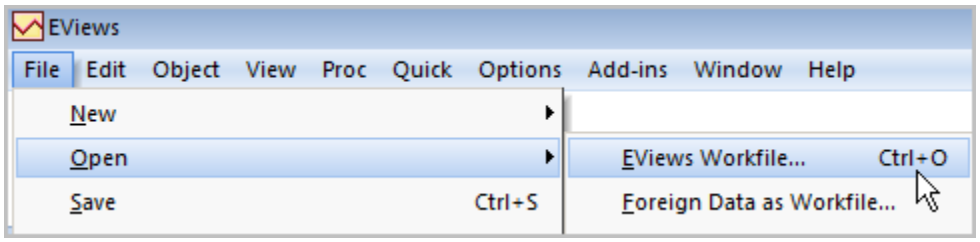
The Simple Linear Regression Model

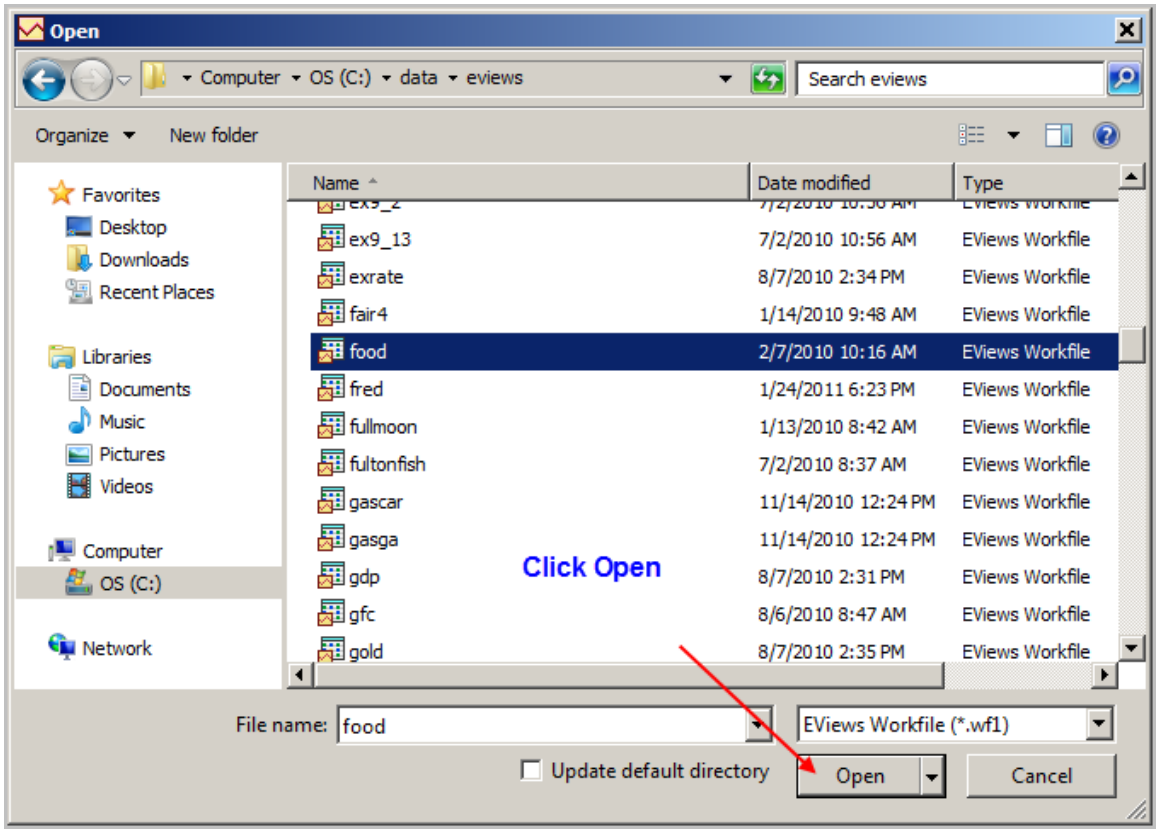
CHAPTER OUTLINE

In this chapter we introduce the simple linear regression model and estimate a model of weekly food expenditure. We also demonstrate the plotting capabilities of EViews and show how to use the software to calculate the income elasticity of food expenditure, and to predict food expenditure from our regression results.

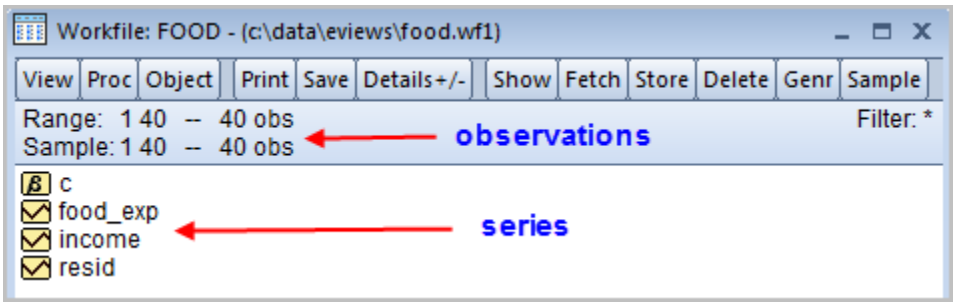
2.1 OPEN THE WORKFILE

The data for the food expenditure example are contained in the workfile ***food.wf1***. Locate this file and open it by selecting **File/Open/EViews Workfile**



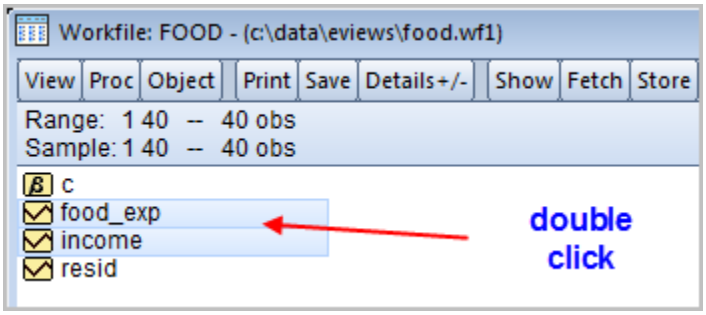


The initial workfile contains two variables *INCOME*, which is weekly household income, and *FOOD_EXP*, which is weekly household food expenditure. See the definition file ***food.def*** for the variable definitions.

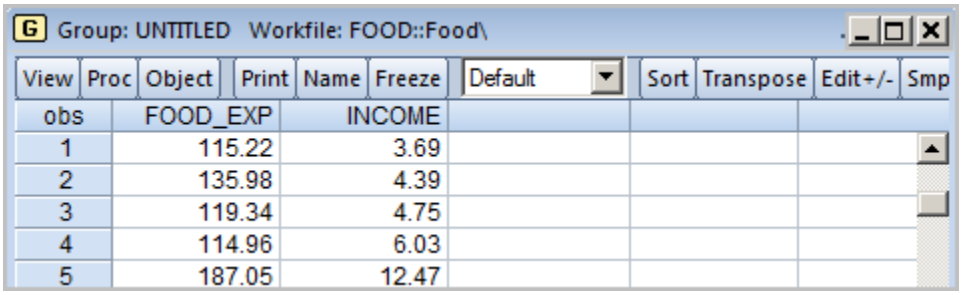


2.1.1 Examine the data

Whenever opening a new workfile it is prudent to examine the data. Select *INCOME* by clicking it, and then, while holding, the **Ctrl**-key select *FOOD_EXP*.



Double-click in the blue area and select **Open Group**. The data appear in a spreadsheet format, with *INCOME* first since it was selected first.



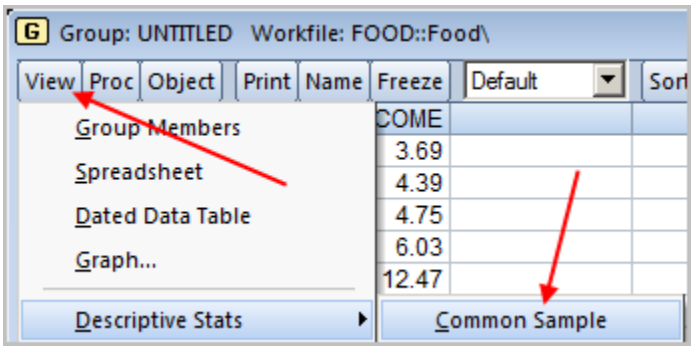
obs	FOOD_EXP	INCOME
1	115.22	3.69
2	135.98	4.39
3	119.34	4.75
4	114.96	6.03
5	187.05	12.47

2.1.2 Checking summary statistics

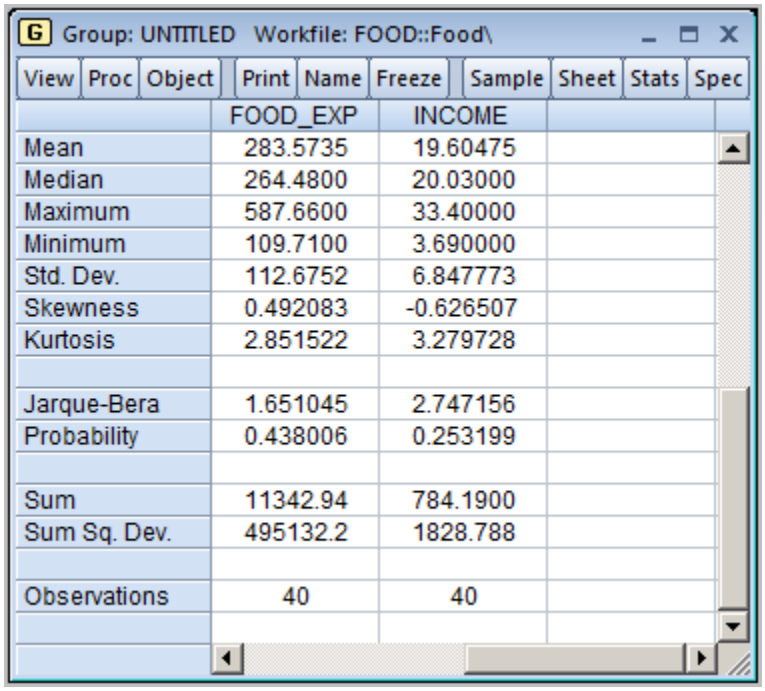
In the definition file ***food.def*** we find variable definitions and summary statistics.

```
food.def

food_exp income

  Obs:   40

  1. food_exp (y)                  weekly food expenditure in $
  2. income   (x)                  weekly income in $100



    Variable |       Obs        Mean    Std. Dev.       Min        Max
-------------+--------------------------------------------------------
    food_exp |        40    283.5735    112.6752      109.71     587.66
      income |        40    19.60475    6.847773        3.69       33.4
```

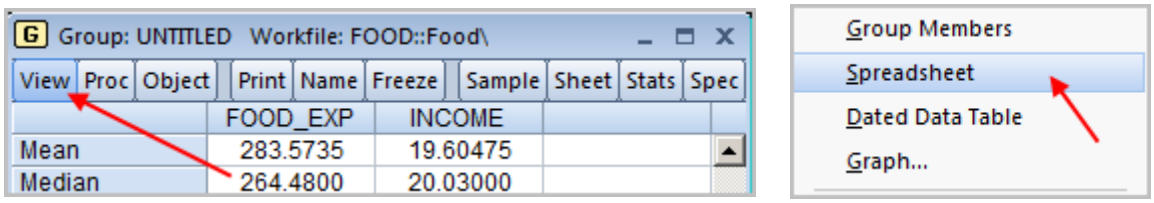
To verify that the workfile we are using agrees, select **View/Descriptive Stats/Common Sample**.



The resulting summary statistics agree with the information in the ***food.def***, which assures us that we have the correct data.

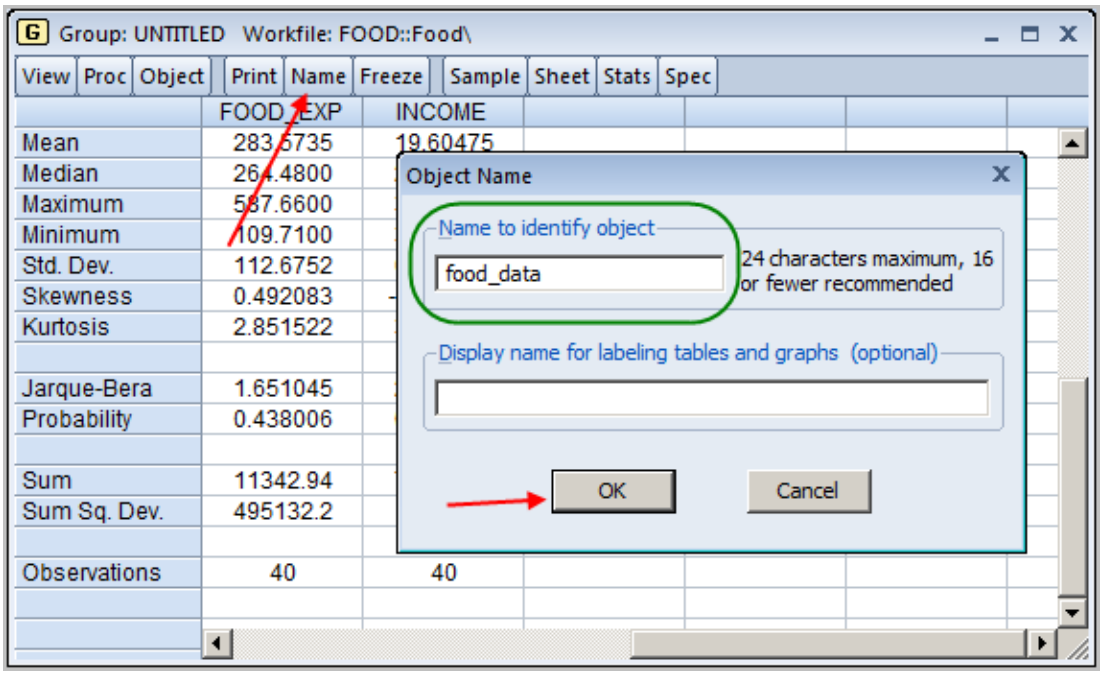


To return to the spreadsheet view, select **View/Spreadsheet.**

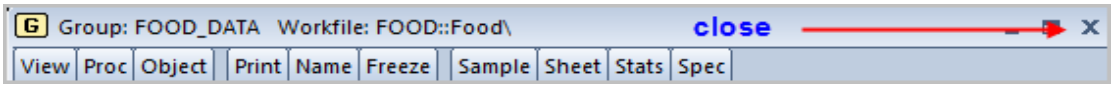


2.1.3 Saving a group

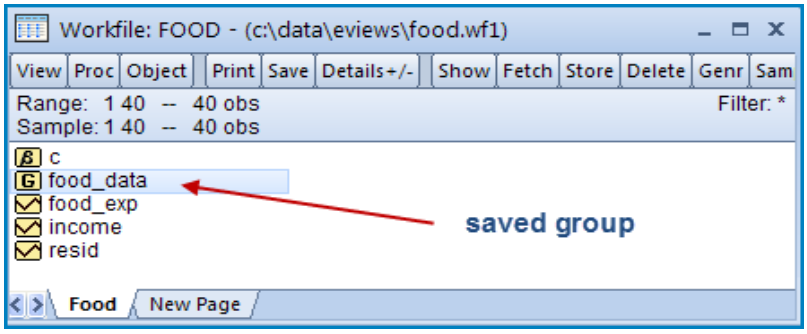
It is often useful to save a particular group of variables that are in a spreadsheet. From within the Group screen, select **Name** and then assign an **Object Name**. Click **OK**.



Close the spreadsheet by clicking the upper-right-hand corner.

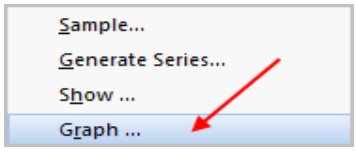


The new object in the workfile is a **Group** named **FOOD_DATA**.

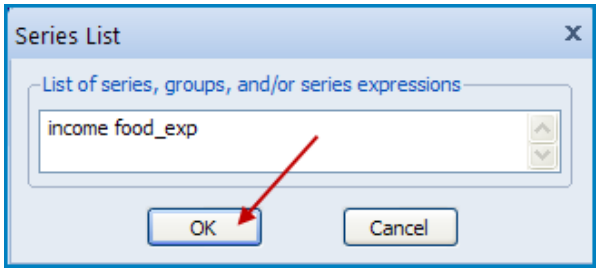


2.2 PLOTTING THE FOOD EXPENDITURE DATA

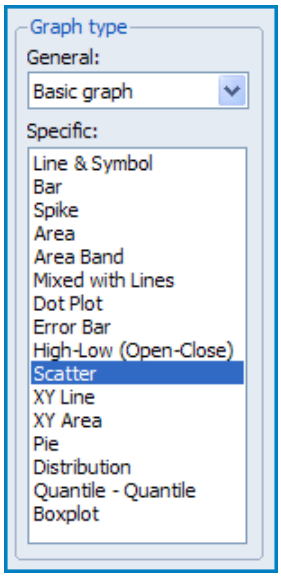
With any software there are several ways to accomplish the same task. We will make use of EViews "drop-down menus" until the basic commands become familiar. Click on **Quick/Graph**



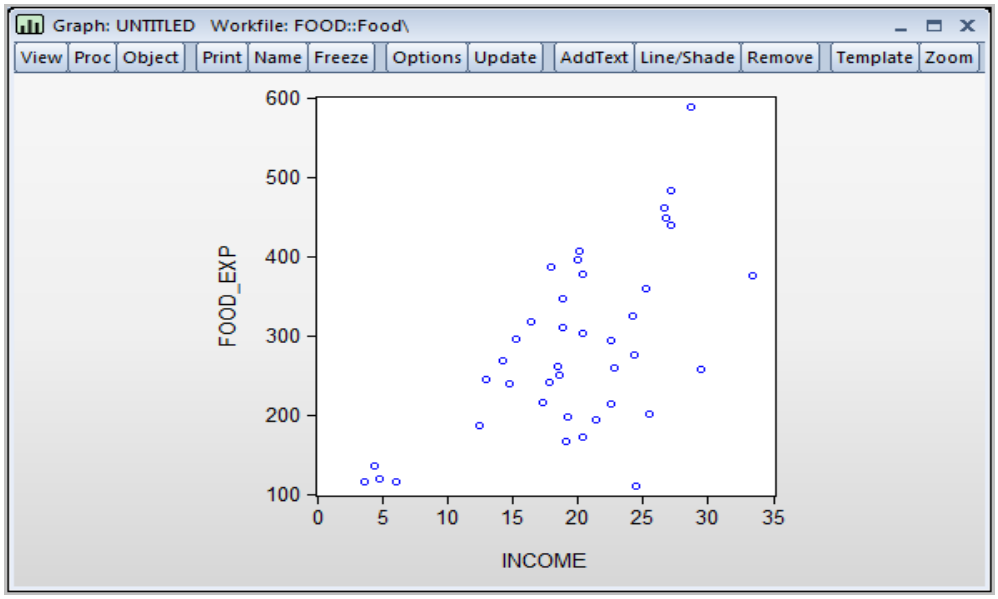
In the dialog box type the names of the variables <u>with the *x*-axis variable coming first!</u>



In the **Graph Options** box select S**catter** from among the **Basic graphs**.



A plot appears, to which we can add labels and a title.



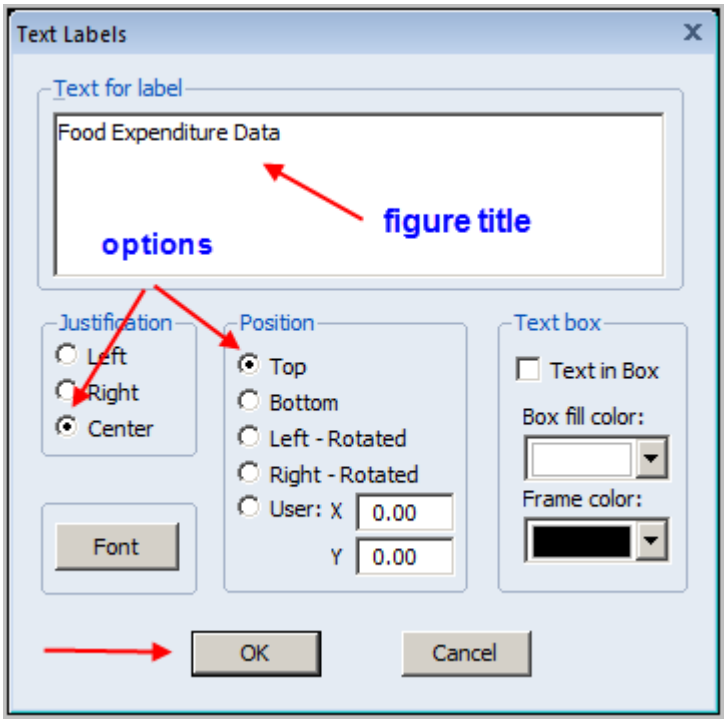
2.2.1 Enhancing the graph

While the basic graph is fine, for a written paper or report it can be improved by

- adding a title
- changing the scale on the vertical axis

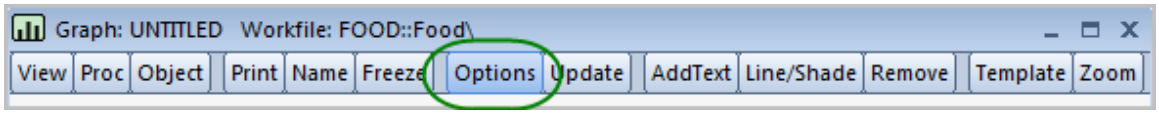
These tasks are easily accomplished. To add a title, click on **AddText** on the Graph menu.

In the resulting dialog box you will be able to add a title, specify the location of the title, and use some stylistic features.



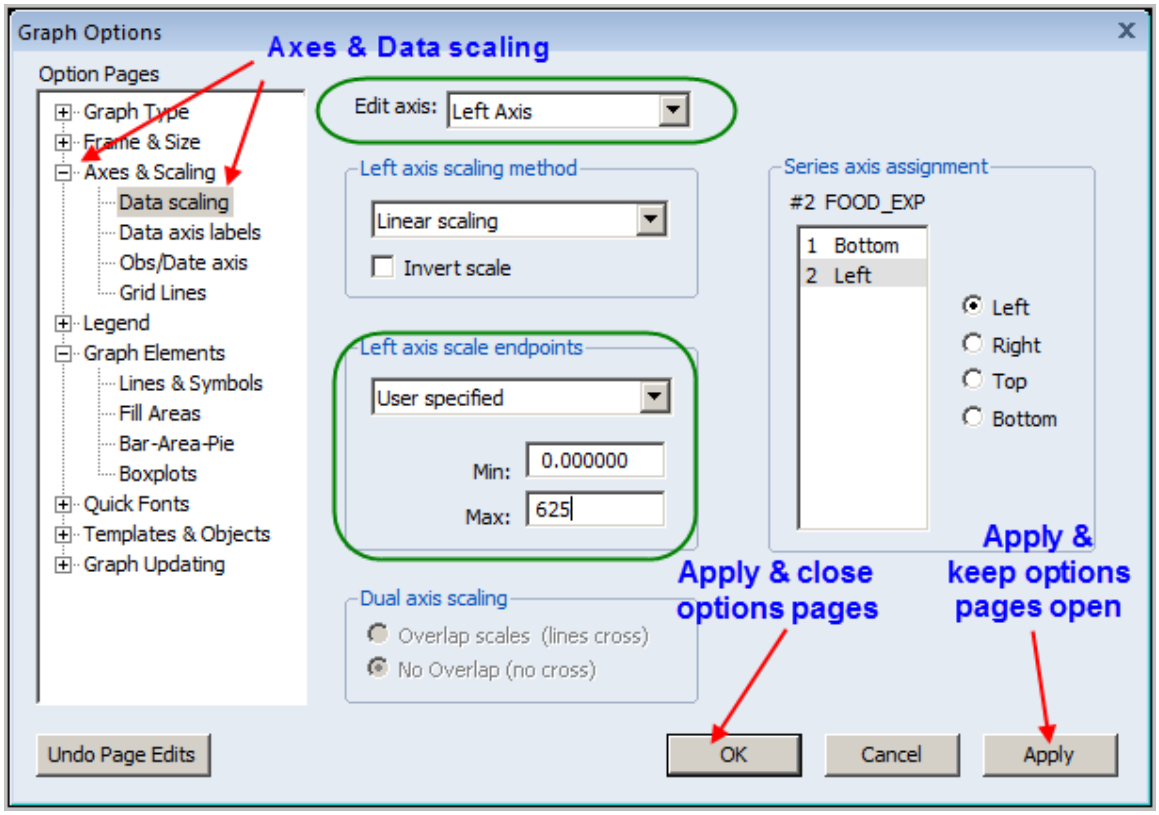
To center the title at the top, click the appropriate options and type in the title. Click **OK**.

To alter the vertical axis so that it begins at zero, click on **Options** on the Graph Menu.

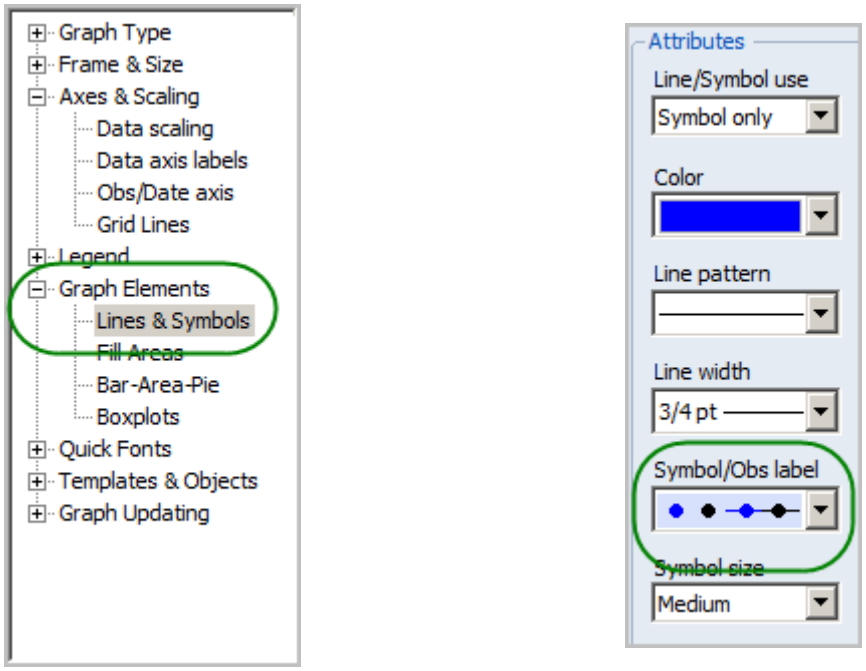


Alternatively, **double-click** inside the graph itself. Click on the **Axes/Scale** option, select the **Left Axis** from the pull-down **Edit axis** menu. Choose **User specified** in the **Left axis scale method.**

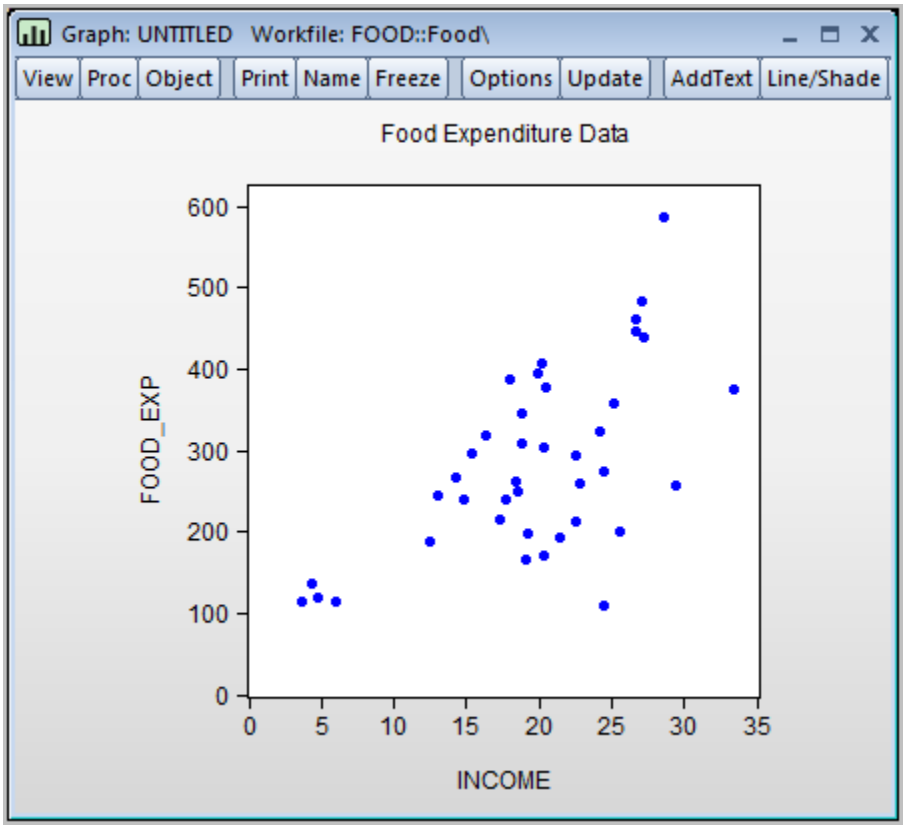
Enter 0 and 625 as the **Min** and **Max** values. Click **OK** to **return** to the graph. To make further changes, click **Apply**.



To change the "empty circles" used in the graph to "filled circles", choose **Graph Elements/ Lines & Symbols**. In the **Attributes** panel choose **Symbol/Obs label** and from the pull-down menu select the solid-looking circles. Note that other attributes can be changed as well.



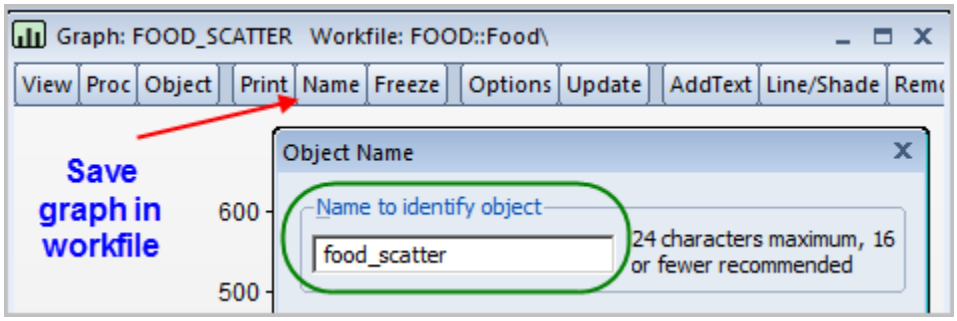
Click **OK**. The resulting graph is now



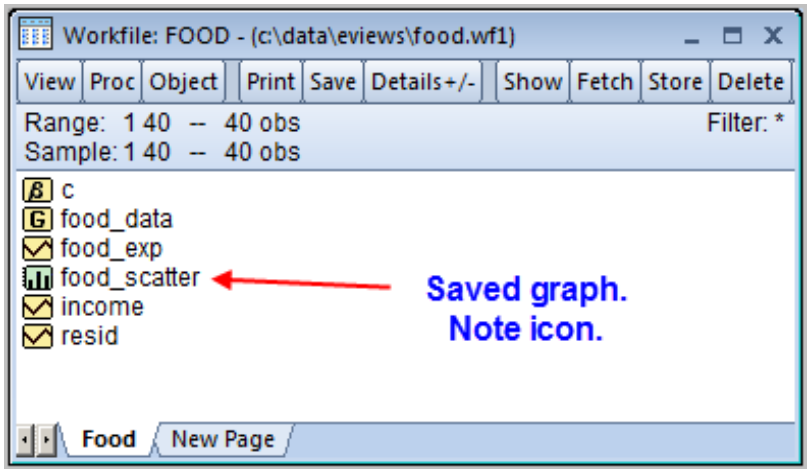
Explore the other **Graph Options** to see all the features.

2.2.2 Saving the graph in the workfile

To save the graph so that it remains in the workfile, click on **Name**, then enter a name. Note that separate words are not allowed, but separating words with an underscore is an alternative.

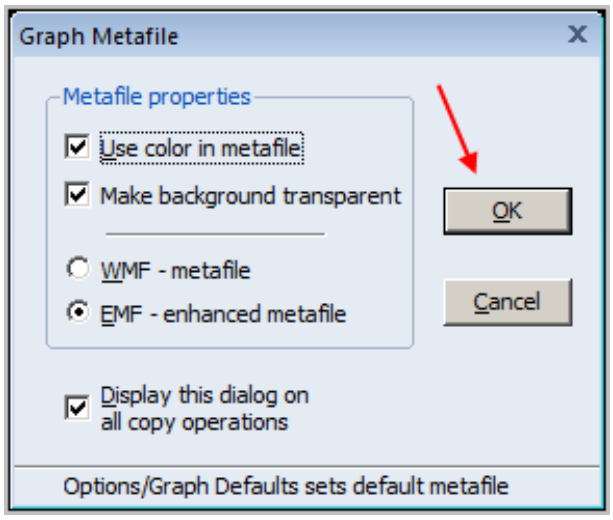


In the workfile, you will find an icon representing the graph just created:

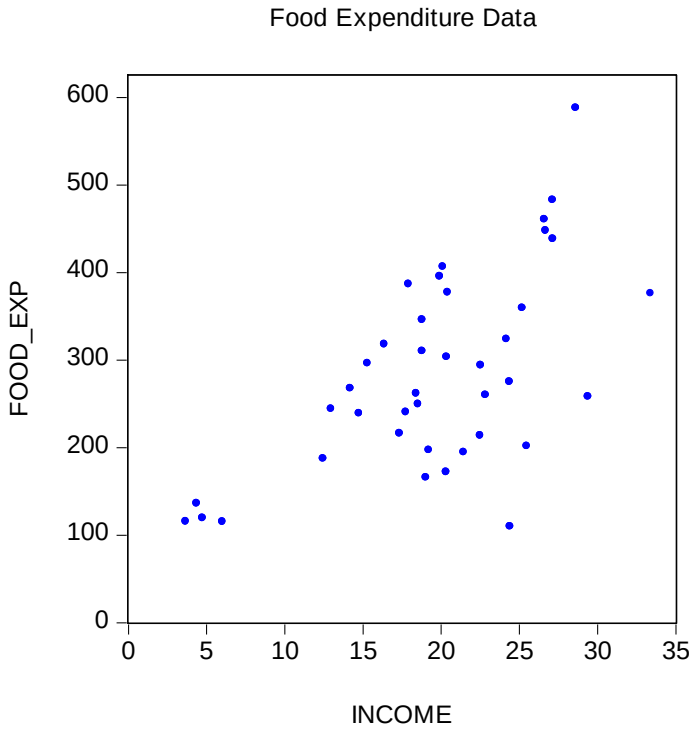


2.2.3 Copying the graph to a document

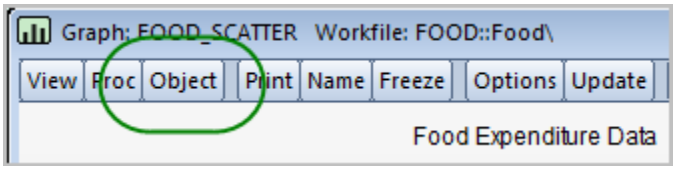
As is usual with Windows-based applications, we can copy by clicking somewhere inside the graph, to select it, then **Ctrl+C**. Or in the main window, click on **Edit/Copy**



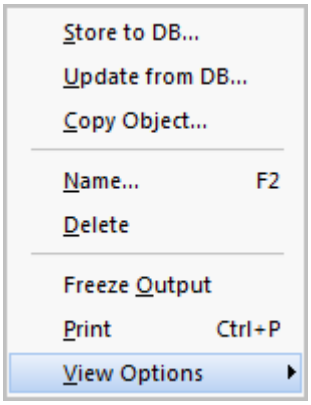
The dialog box that shows up allows you to choose the file format. Switch to your word processor and simply paste the graph (**Ctrl+V)** into the document, as we have done below.

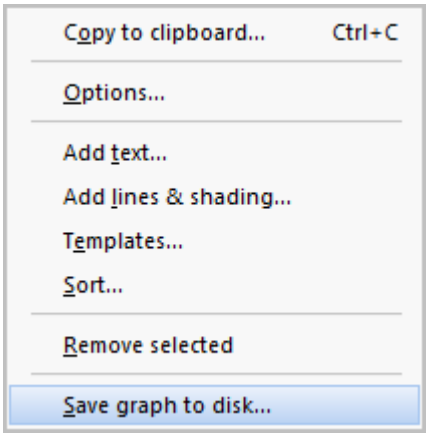


To save the graph to a disk, select the **Object** button on the Graph menu.



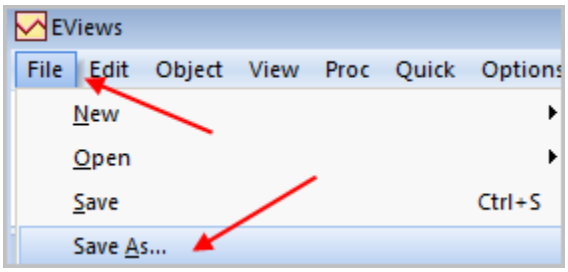
Select **View Options/Save graph to disk**. In the resulting dialog box you have several file types to choose from, and you can select a name for the graph image.



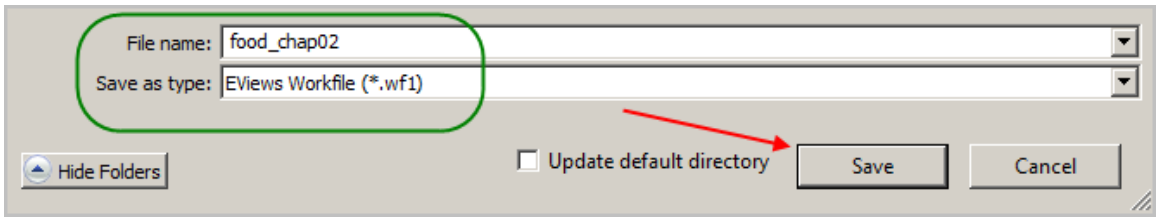


2.2.4 Saving a workfile

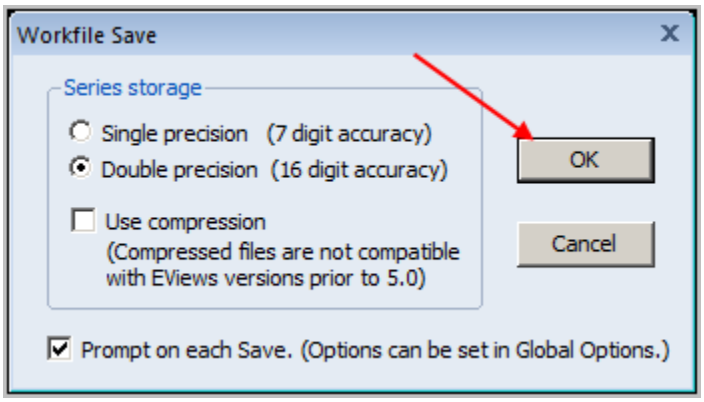
You may wish to save your workfile at this point. If you select the **Save** button on the workfile menu, the workfile will be saved under its current name ***food.wf1***. It might be better to save this file under a new name, so that the original workfile remains untouched. Select **File/Save As** on the EViews menu.



Select a simple but informative name.



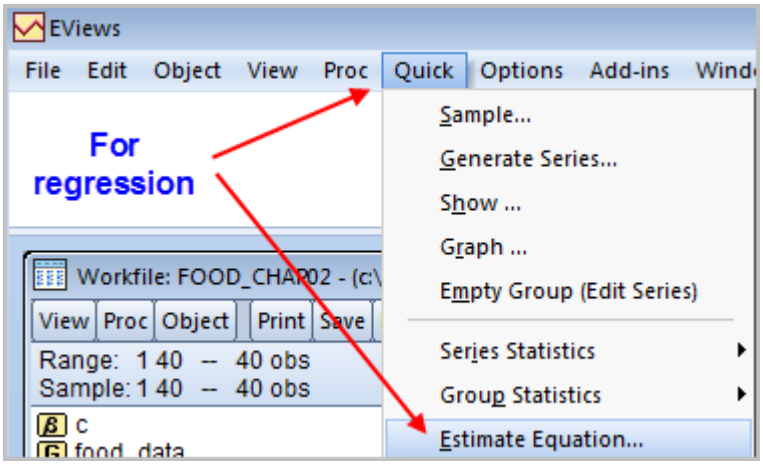
EViews will ask the precision. Choose the default.



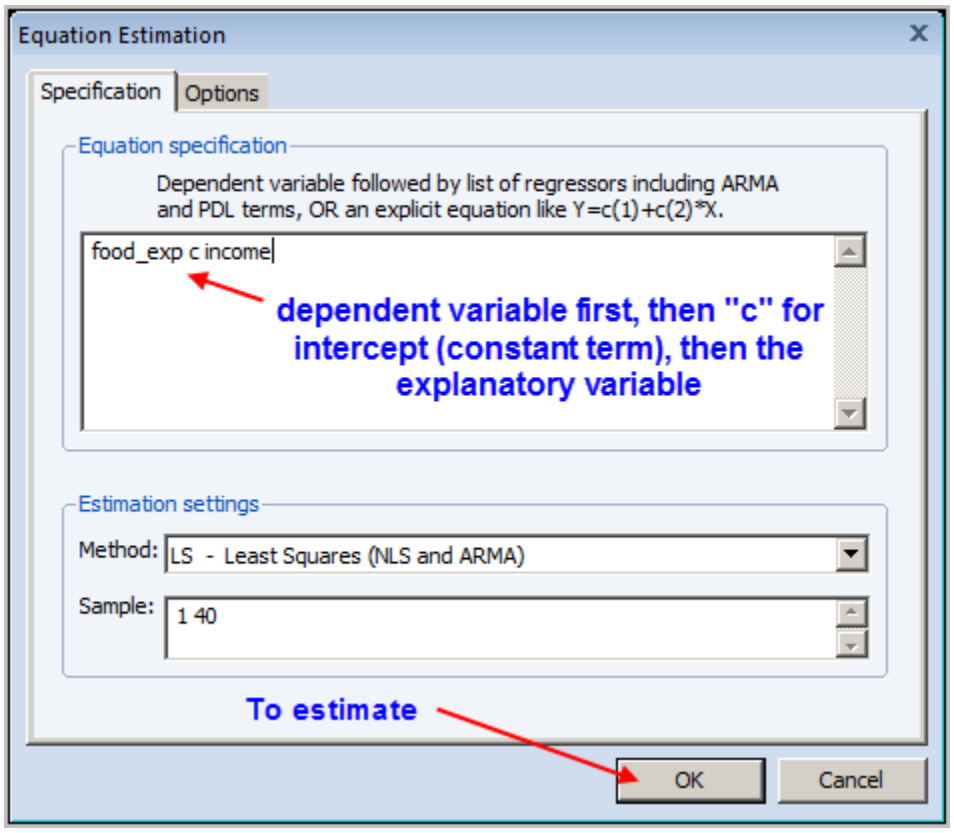
We have named it ***food_chap02.wf1***. Once saved with a name, it can be re-saved using **Ctrl+S**, or by selecting **File/Save**.

2.3 ESTIMATING A SIMPLE REGRESSION

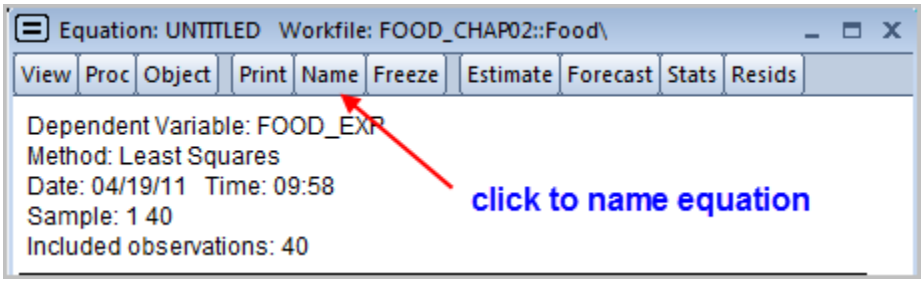
To obtain the least squares parameter estimates for the food expenditure equation, we select **Quick/Estimate Equation** from the EViews menu.



In the **Equation Specification** dialog box, type the dependent variable *FOOD_EXP* (the *y* variable) first, C (which is EViews notation for the intercept term, or constant), and then the independent variable *INCOME* (the *x* variable). Note that in the **Estimation settings** window, the **Method** is **Least Squares** and the **Sample** is **1 40**. Click **OK**.



The estimated regression output appears. EViews produces an equation object in its default **Stats** view. We can name the equation object to save it permanently in our workfile by clicking on **Name** in the equation's toolbar. We have named this equation **FOOD_EQ**.



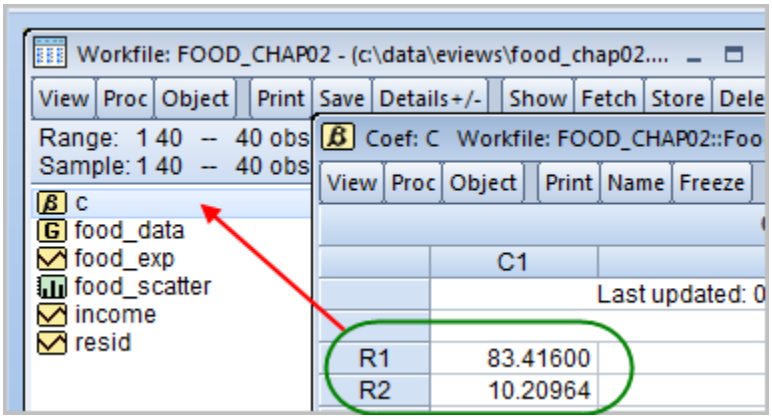
The top portion of the regression output is

Dependent Variable: FOOD_EXP
Method: Least Squares
Date: 04/19/11 Time: 09:58
Sample: 1 40
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	83.41600	43.41016	1.921578	0.0622
INCOME	10.20964	2.093264	4.877381	0.0000

Note that the estimated coefficient $b_1 = 83.41600$, the intercept in our food expenditure model, is recorded as the coefficient on the variable C. C is the EViews term for the constant in a regression model. We cannot name any of our variables C since this term is reserved exclusively for the constant or "intercept" in a regression model. In addition to b_1 = 83.41600, the EViews output shows that the estimated value of the slope coefficient on the variable weekly income (X) is $b_2 = 10.20964$, as reported in *POE4*, Chapter 2.3.2. The interpretation of b_2 is: for every \$100 increase in weekly income we estimate that there is about a \$10.21 increase in weekly food expenditure, holding all other factors constant.

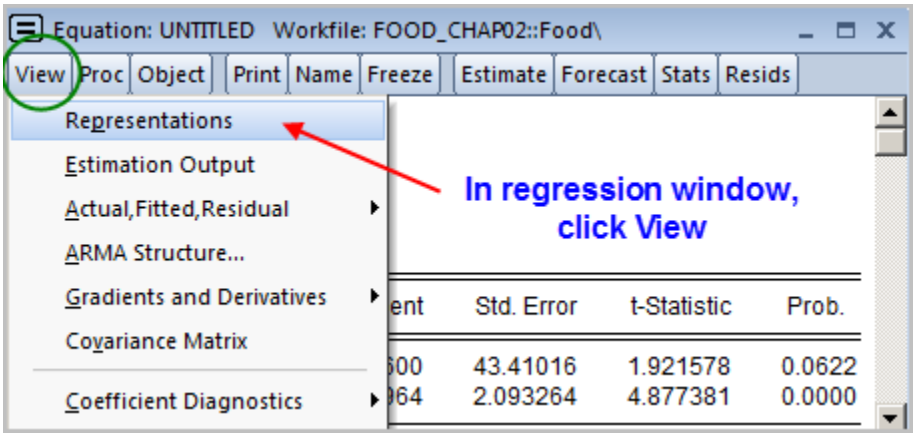
In the workfile window, double-click on the vector object **C**. It always contains the estimated coefficients from the most recent regression.



The series *RESID* always contains the least squares residuals from the most recent regression. We will return to this shortly.

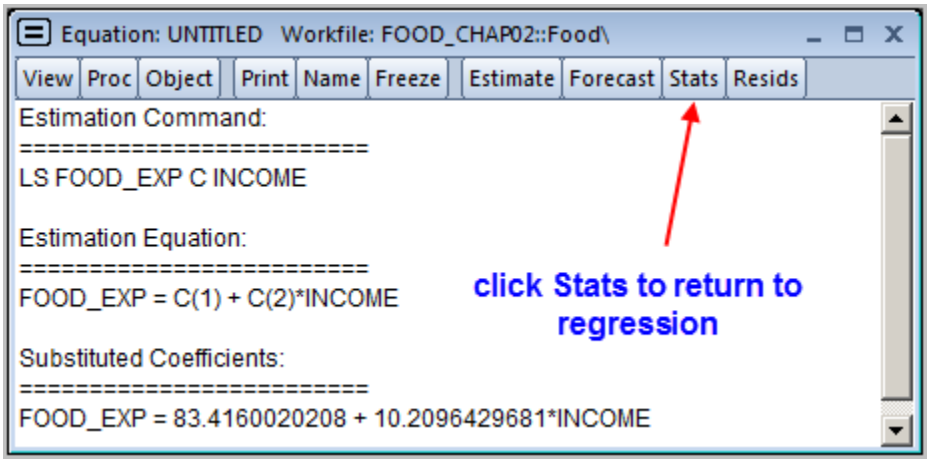
2.3.1 Viewing equation representations

One EViews button that we will use often is the **View/Representations** button in a regression window:



The resulting display shows three things:

- The **Estimation Command** is what can be typed into the Command window to obtain the equation results.
- The **Estimation Equation** shows the coefficients and how they are linked to the variables on the equation's right side: C(1) is the intercept and C(2) is the slope.
- The **Substituted Coefficients** displays the fitted regression line.



To return to the regression window click **Stats**.

2.3.2 Computing the income elasticity

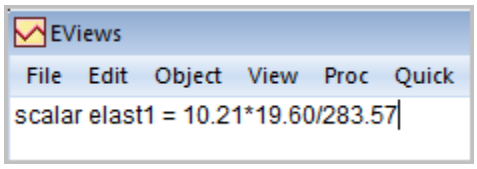
As shown in equation (2.9) of *POE4*, the income elasticity is defined to be

$$\varepsilon = \frac{\Delta E(y)/E(y)}{\Delta x/x} = \frac{\Delta E(y)}{\Delta x}\cdot\frac{x}{E(y)} = \beta_2 \cdot \frac{x}{E(y)}$$

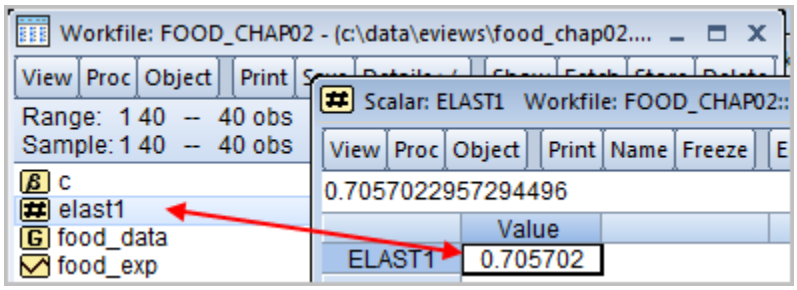
which is then implemented by replacing unknowns by estimated quantities,

$$\hat{\varepsilon} = b_2 \cdot \frac{\bar{x}}{\bar{y}} = 10.21 \times \frac{19.60}{283.57} = 0.71$$

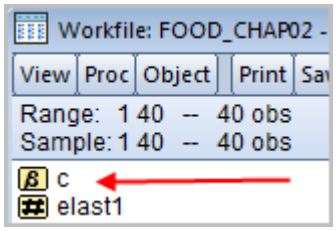
We can use EViews as a "calculator" by simply typing into the Command window



then pressing **Enter**. The word **scalar** means that the result is a single number. An icon appears in the workfile. Double-click in the shaded area:



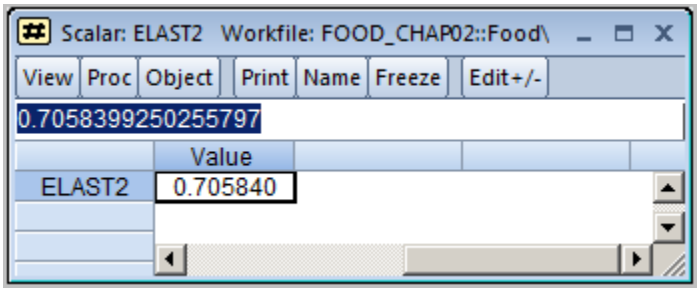
While this gives the answer, there is something to be said for using the power of EViews to simplify the calculations. EViews saves the estimates from the most recent regression in the workfile. They are obtained by double clicking the "$\boldsymbol{\beta}$" icon:



These coefficients can be accessed from the array **@coefs**. Also, EViews has functions to compute many quantities. The arithmetic mean is computed using the function **@mean**. Thus the elasticity can also be obtained by entering into the Command window

```
scalar elast2 = @coefs(2)*@mean(income)/@mean(food_exp)
```

The result is slightly different from the first computation because in the first we used "rounded-off" values of the sample means.



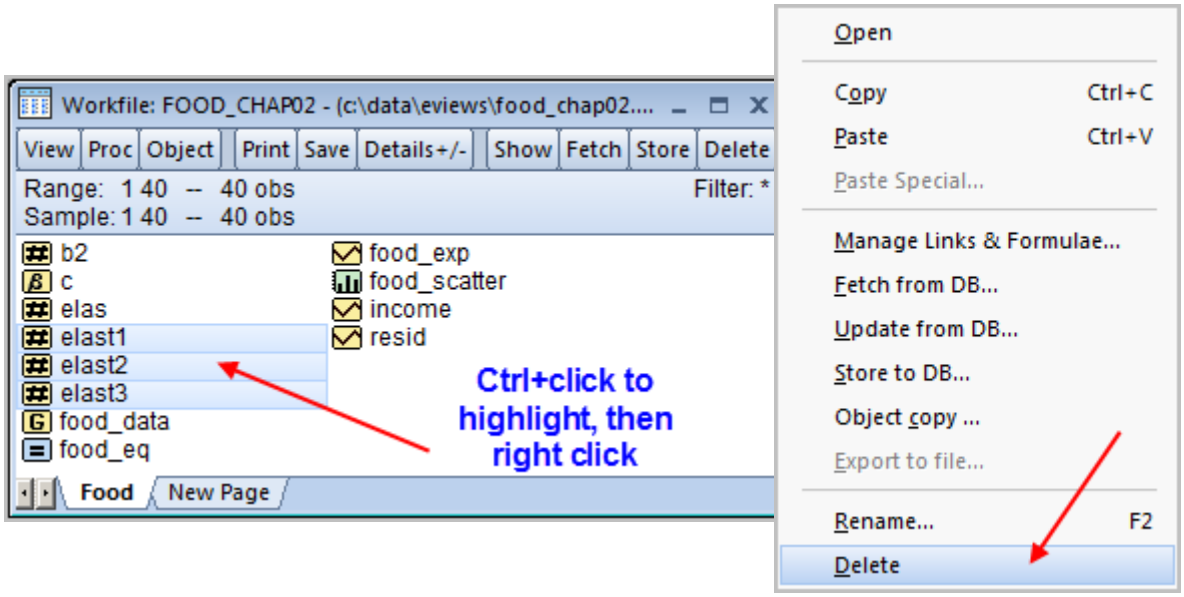
Because the array **@coefs** is not permanent, you may want to save the slope estimate as a separate quantity by entering the commands

```
scalar b2 = @coefs(2)
scalar elast3 = b2*@mean(income)/@mean(food_exp)
```

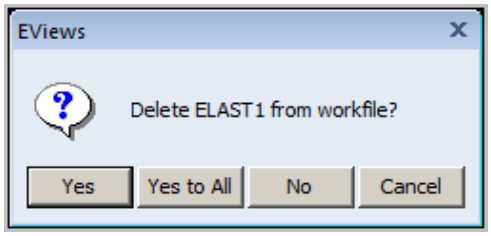
However, the coefficient array can always be retrieved if the food equation has been saved and named. Recall that we did save it with the name **FOOD_EQ**. By saving the equation we also save the coefficients, which can be retrieved from the array **FOOD_EQ.@coefs**.

```
scalar elas = food_eq.@coefs(2)*@mean(income)/@mean(food_exp)
```

We have some surplus icons in our workfile now. Keep **B2** and **ELAS**. To clean out the other elasticties, highlight (hold down **Ctrl** and click each), right-click in the blue area, and select **Delete**.



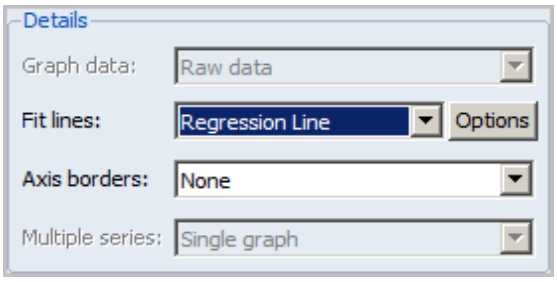
EViews will check to see if you are sure.



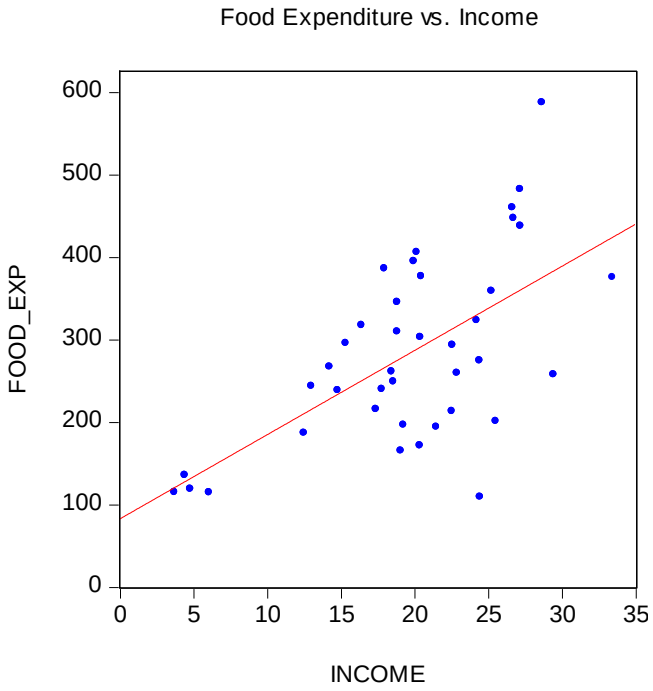
Choose **Yes to All** to delete all three objects from the workfile. **Save** the workfile, **Ctrl+S**.

2.4 PLOTTING A SIMPLE REGRESSION

Select **Quick/Graph** from the EViews menu and repeat the steps in Section 2.2 to create the scatter diagram. We will add the fitted least squares line to the graph. In the **Details** section, using the **Fit lines** drop-down menu, select **Regression Line**.



Click inside the graph, enter **Ctrl+C**, **OK**, and then paste into a document using **Ctrl+V**. The graph should look like this:



Return to EViews and in the Graph window select the **Name** button and assign a name to this object, such as **FITTED_LINE**.

2.5 PLOTTING THE LEAST SQUARES RESIDUALS

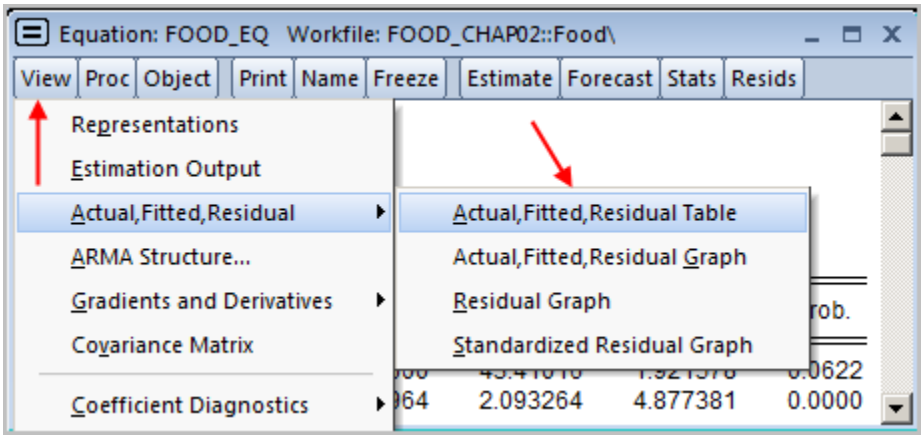
The least squares residuals are defined as

$$\hat{e}_i = y_i - \hat{y}_i = y_i - b_1 - b_2 x_i$$

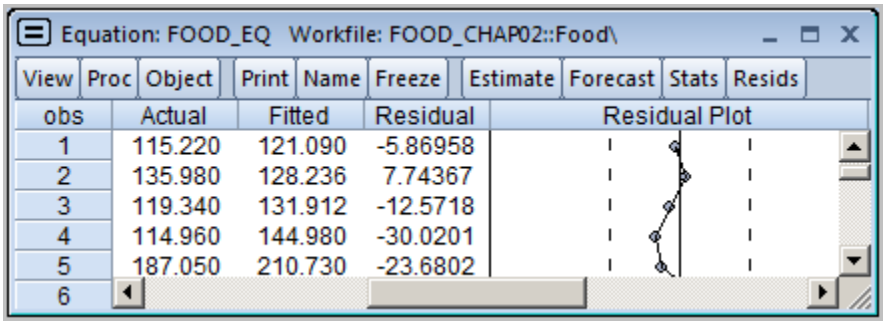
As you will discover, these residuals are important for many purposes. To view the residuals, open the saved regression results in **FOOD_EQ** by double-clicking the icon.

2.5.1 Using View options

Within the equation **FOOD_EQ** window, click on **View** then **Actual, Fitted, Residual**. There you can select to view a table or several graphs.

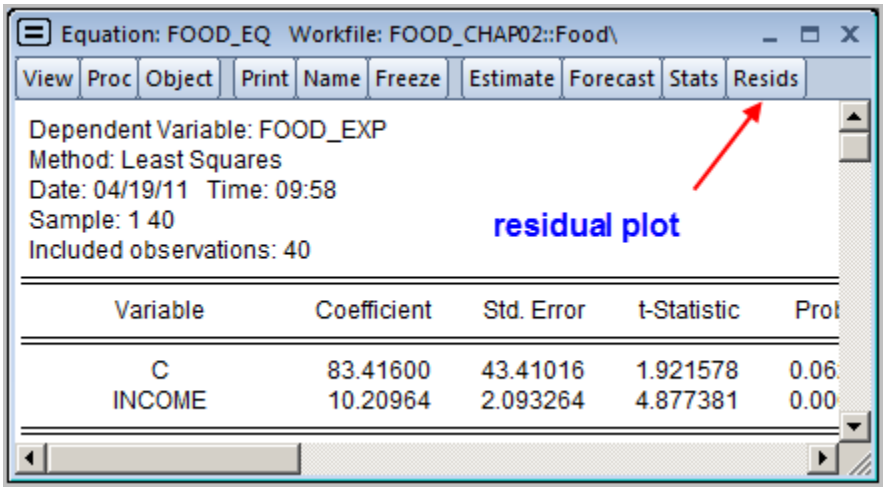


If you select **Actual, Fitted, Residual Table** you will see the values of the dependent variable *y*, the predicted (fitted) value of *y*, given by $\hat{y} = b_1 + b_2 x$, and the least squares residuals, along with a plot.

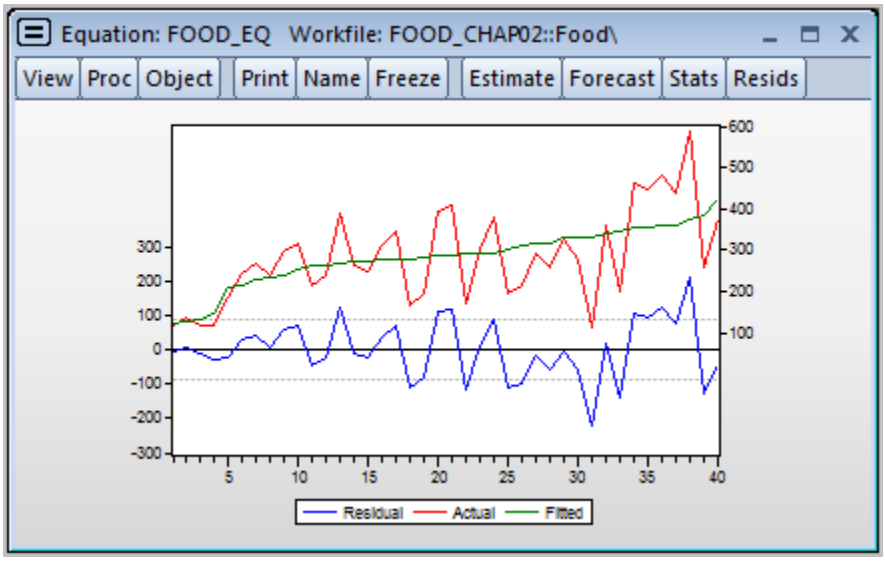


2.5.2 Using Resids plot

Within the object **FOOD_EQ** you can navigate by selecting buttons. Select **Resids**.

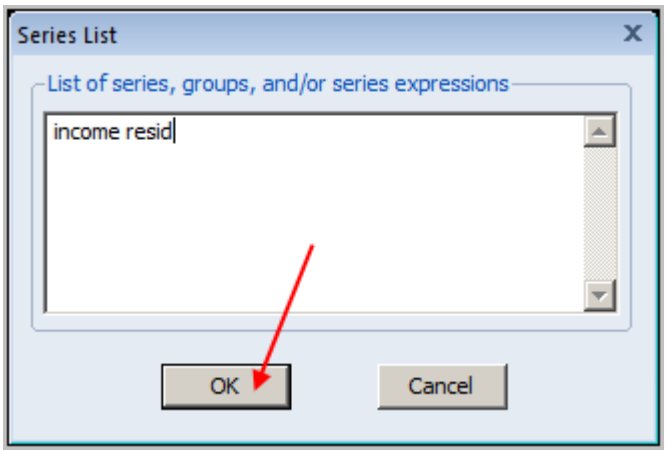


The result is a plot showing the least squares residuals (lower graph) along with the actual data (*FOOD_EXP*) and the fitted values. When using this plot, note that the horizontal axis is the **observation number** and not *INCOME*. In this workfile the data happen to be sorted by income, but note that the fitted values are not a straight line. When examining residual plots, a **lack of pattern** is consistent with the assumptions of the simple regression model.

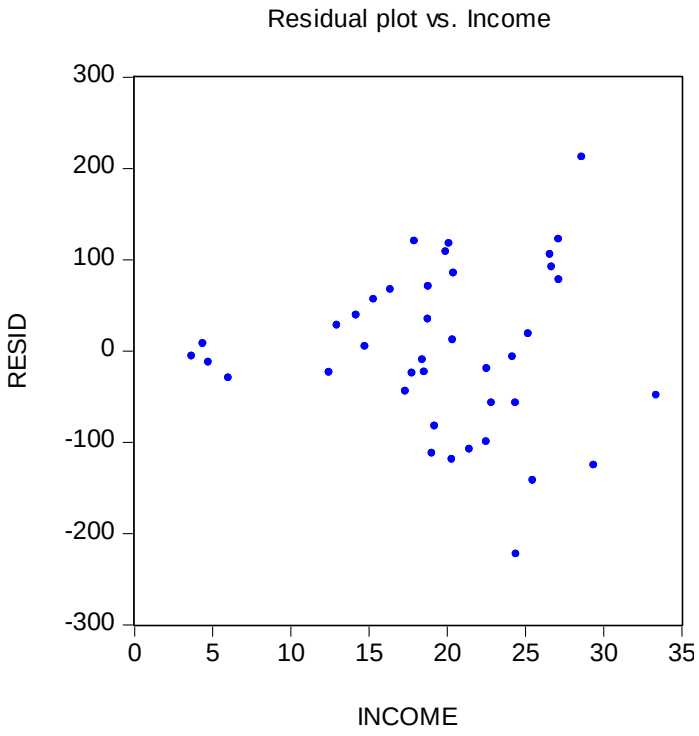


2.5.3 Using Quick/Graph

To create a graph of the residuals against income we can use the fact the EViews saves the residuals from the most recent regression in the series labeled *RESID*. Click on **Quick/Graph**. In the dialog box enter *INCOME* (*x*-axis comes first) and *RESID*.



Choose the **Scatter** plot. Edit the resulting plot to add title and change symbols if desired. The resulting plot shows how the residuals relate to the values of income.

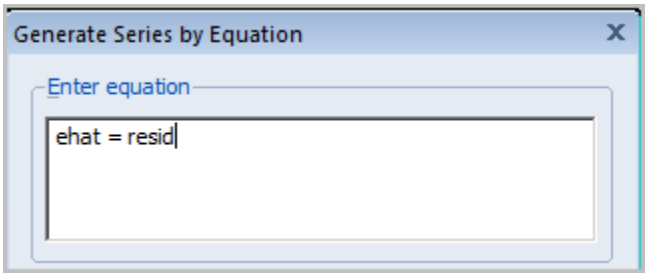


Save this plot by selecting **Name** and assigning **RESIDUAL_PLOT**.

2.5.4 Saving the residuals

To save these residuals for later use, we must **Generate** a new variable (series). In the workfile screen click **Genr** on the menu.

In the resulting dialog box create a new variable called *EHAT* that contains the residuals:



Click **OK**. Alternatively, simply type into the Command window

series ehat = resid

2.6 ESTIMATING THE VARIANCE OF THE ERROR TERM

The estimator for σ^2, the variance of the error term, is

$$\hat{\sigma}^2 = \frac{\sum \hat{e}_t^2}{N-2} = \frac{\text{Sum squared resid}}{N-2}$$

where **Sum squared resid** is the EViews name for the sum of squared residuals. The square root of the estimated error variance is called the **Standard Error of the Regression** by EViews,

$$\text{S.E. of regression} = \hat{\sigma} = \sqrt{\frac{\sum \hat{e}_t^2}{N-2}} = \sqrt{\hat{\sigma}^2}$$

Open the regression equation we have saved as **FOOD_EQ**. Below the estimation results you will find the Standard Error of the Regression and the sum of squared least squares residuals.

S.E. of regression	89.51700
Sum squared resid	304505.2

Also reported are the sample mean of the *y* values (**Mean dependent variable**):

$$\text{Mean dependent var} = \bar{y} = \sum y / N$$

The sample standard deviation of the *y* values (**S.D. dependent var**) is

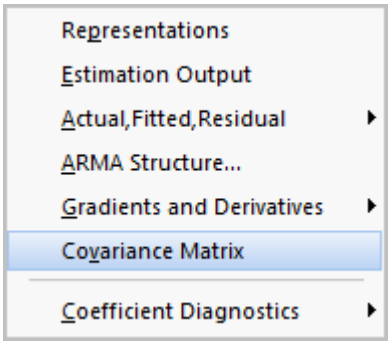
$$\text{S.D. dependent var} = s_y = \sqrt{\frac{\sum(y_i - \bar{y})^2}{N-1}}$$

These are

Mean dependent var	283.5735
S.D. dependent var	112.6752

2.7 COEFFICIENT STANDARD ERRORS

The estimated error variance is used to construct the estimates of the variances and covariances of the least squares estimators as shown in *POE* equations (2.20)-(2.22). These estimated variances can be viewed from the **FOOD_EQ** regression by clicking on **View/Covariance Matrix:**



The elements are arrayed as

$$\begin{bmatrix} \text{var}(b_1) & \text{cov}(b_1, b_2) \\ \text{cov}(b_1, b_2) & \text{var}(b_2) \end{bmatrix}$$

In EViews they appear as

Coefficient Covariance Matrix		
	C	INCOME
C	1884.442	-85.90316
INCOME	-85.90316	4.381752

The highlighted value is the estimated variance of b_2. If we take the square roots of the estimated variances, we obtain the standard errors of the estimates. In the regression output these standard errors are denoted **Std. Error** and are found right next to the estimated coefficients.

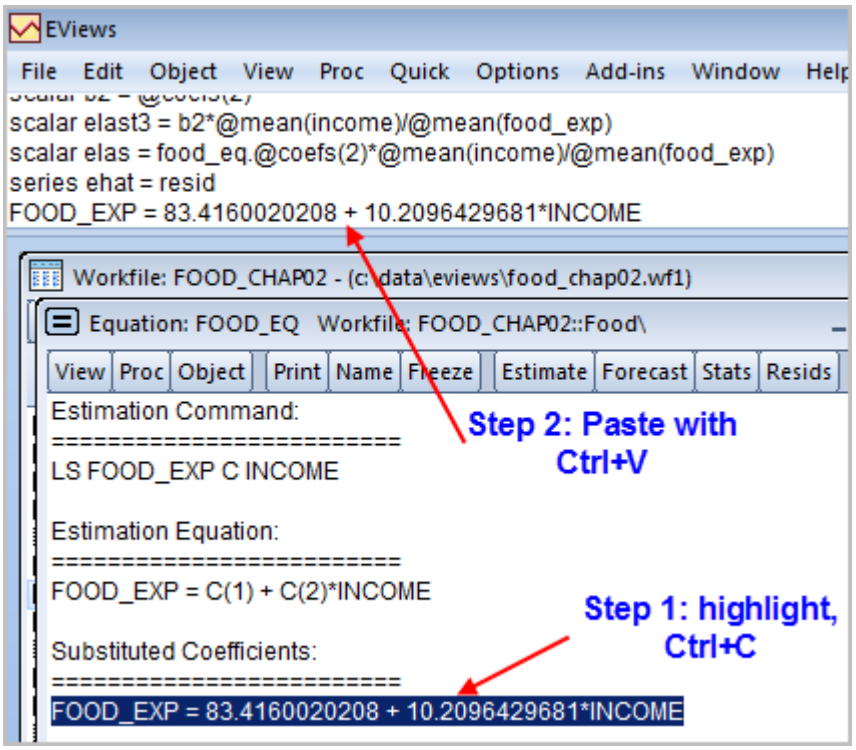
Variable	Coefficient	Std. Error
C	83.41600	43.41016
INCOME	10.20964	2.093264

2.8 PREDICTION USING EVIEWS

There are several ways to create forecasts in EViews; we will illustrate two of them.

2.8.1 Using direct calculation

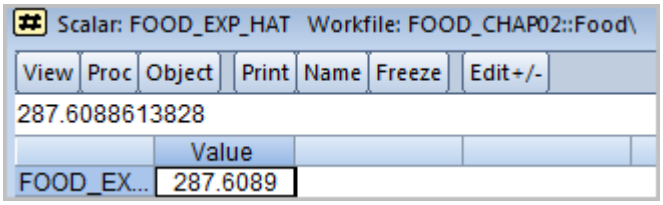
Open the food equation **FOOD_EQ**. Click on **View/Representations**. Select the text of the equation listed under **Substituted Coefficients**. We can choose **Edit/Copy** from the EViews menu bar, or we can simply use the keyboard shortcut **Ctrl+C** to copy the equation representation to the clipboard. Finally, we can paste the equation into the Command window.



To obtain the predicted food expenditure for a household with weekly income of $2000, edit the Command window to read

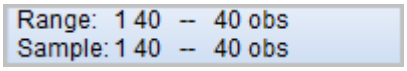
scalar FOOD_EXP_HAT = 83.4160020208 + 10.2096429681*20

Press **Enter**. The resulting scalar value, both formatted and unformatted, is

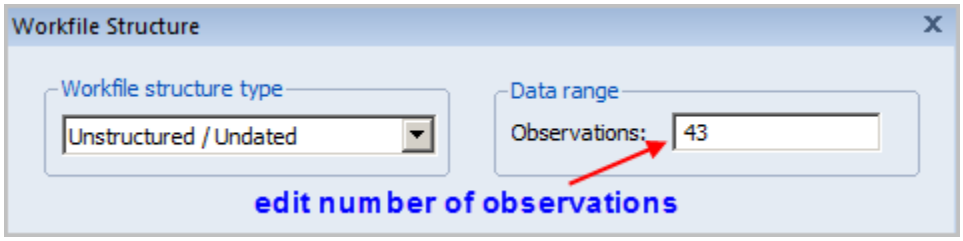


2.8.2 Forecasting

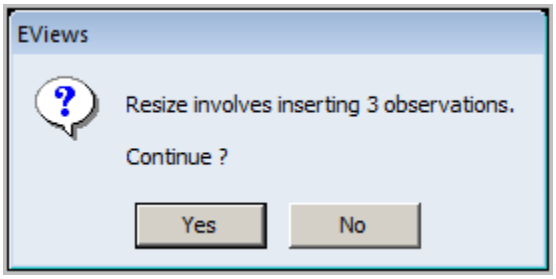
A more general, and flexible, procedure uses the power of EViews. In order to predict we must enter additional x observations at which we want predictions. In the main workfile window, double-click **Range**.



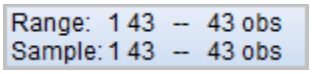
This workfile has an **Unstructured/Undated** structure. Change the number of observations to 43.



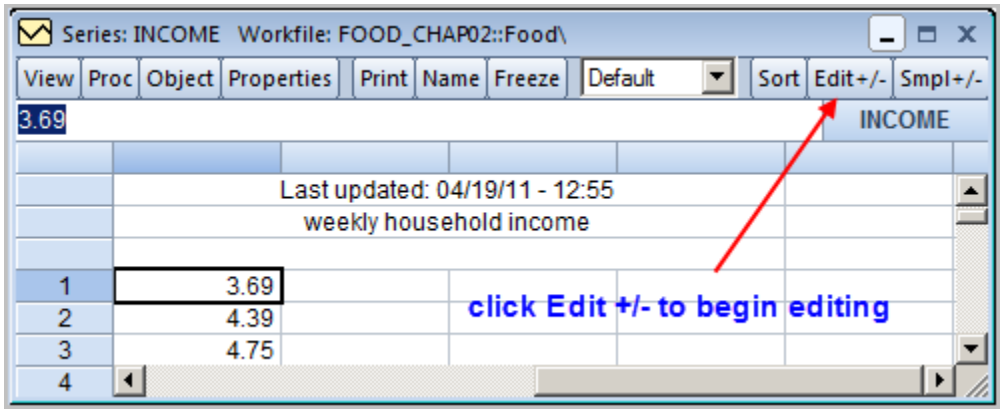
Click **OK**. EViews will check with you to confirm your action.



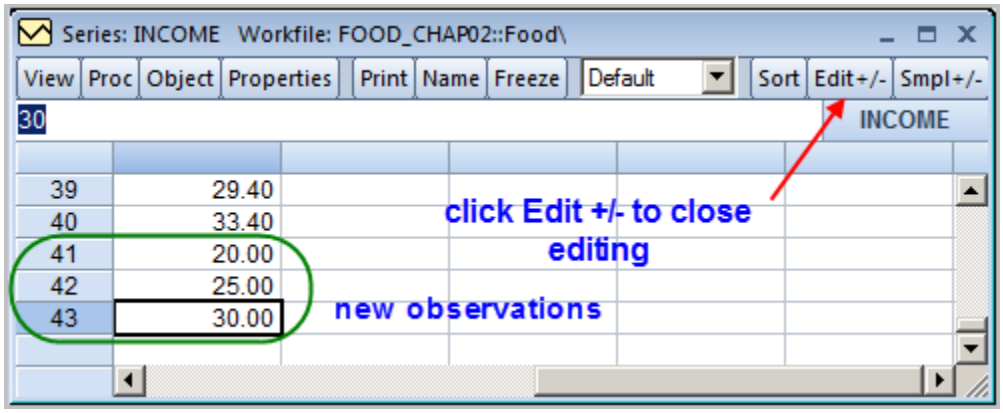
The **Sample** and **Range** will now be 43.



Next, double-click on *INCOME* in the main workfile to open the series, and click the **Edit+/-** button in the series window, which puts EViews in edit mode.

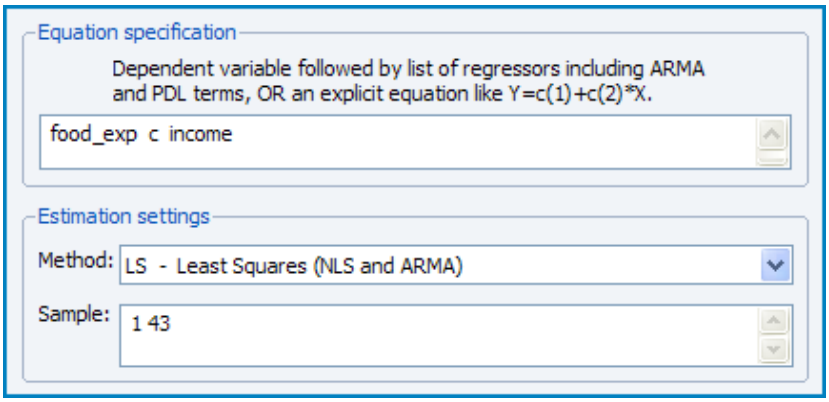


Scroll to the bottom and you see NA in the cells for observations 41-43. Click the cell for observation 41 and enter 20. Enter 25 and 30 in cells 42 and 43, respectively. When you are done, click the **Edit+/-** button again to turn off the edit mode.



Now we have three extra *INCOME* observations that do not have *FOOD_EXP* observations. When we do a regression EViews will toss out the missing observations, but it will use the extra *INCOME* values when creating a forecast.

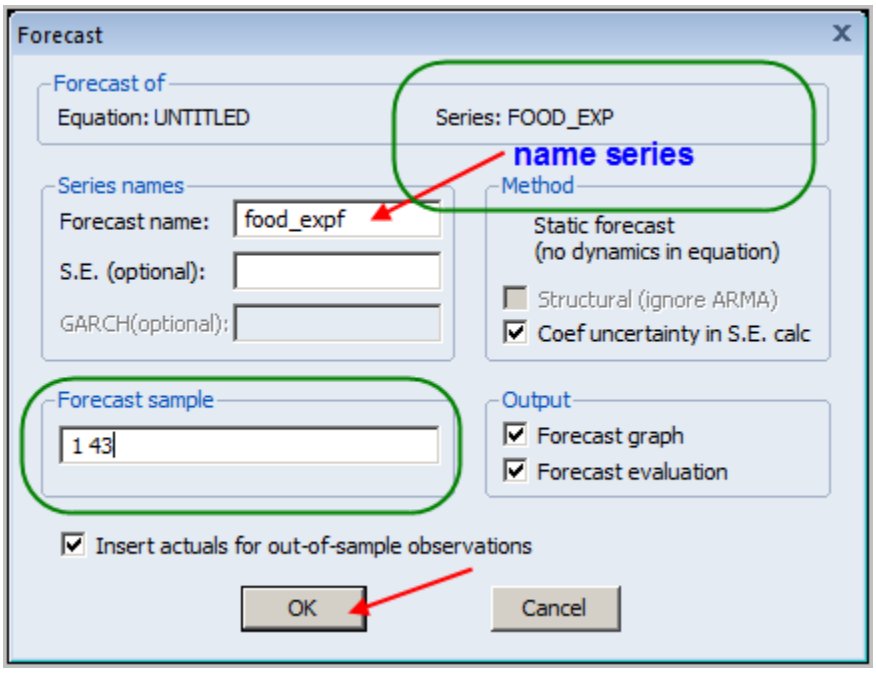
To forecast, first re-estimate the model with the original data. (This step is not actually necessary, but we want to illustrate a point.) Click on **Quick/Estimate Equation**. Enter the equation. Note in the dialog box that the **Sample** is 1 to 43.



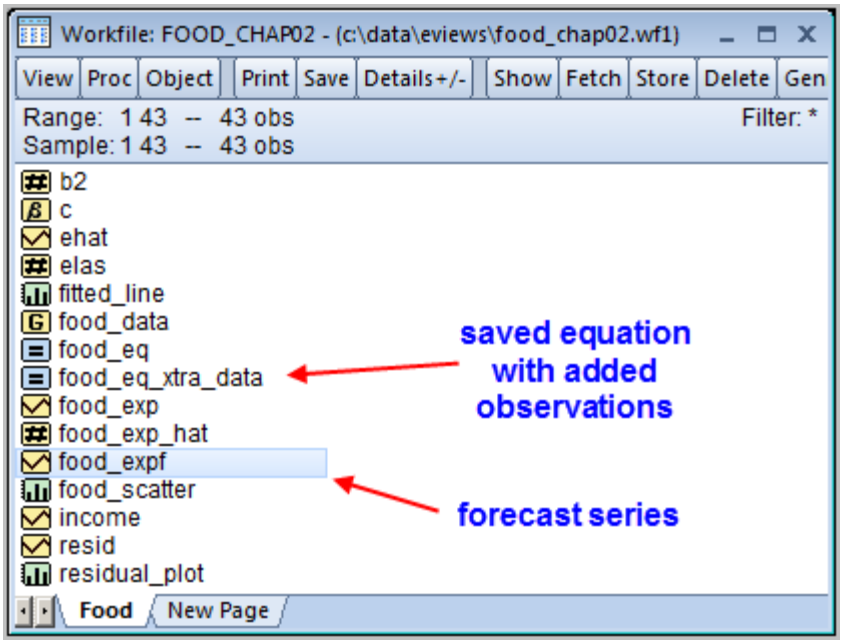
The estimation results are the same, and EViews tells us that the **Included observations** are 40 **after adjustments**. The three observations with no values for *FOOD_EXP* were discarded.

To forecast with the estimated model, click on the **Forecast** button in the equation window.

The **Forecast** dialog box appears. EViews automatically assigns the name **FOOD_EXPF** to the forecast series, so if you want a different name enter it. The **Forecast sample** is 1 to 43. Predictions will be constructed for the 40 samples values and for the 3 new values of *INCOME*. For now, ignore the other options. Click **OK**.



A graph appears showing the fitted line for observations 41-43 along with lines labeled **±2 S.E.** We will discuss these later. To see the fitted values themselves, in the workfile window, double-click on the series named *FOOD_EXPF* and scroll to the bottom.



The three forecast values corresponding to incomes 20, 25 and 30 are in cells 41, 42 and 43. The value in cell 41 is 287.6089, which is the same predicted value obtained earlier in Chapter 2.3.3b.

While this approach is somewhat more laborious, by using it we can generate forecasts for many observations at once. More importantly, using EViews to forecast will make other options available to us that simple calculations will not.

2.9 ESTIMATING A NONLINEAR RELATIONSHIP

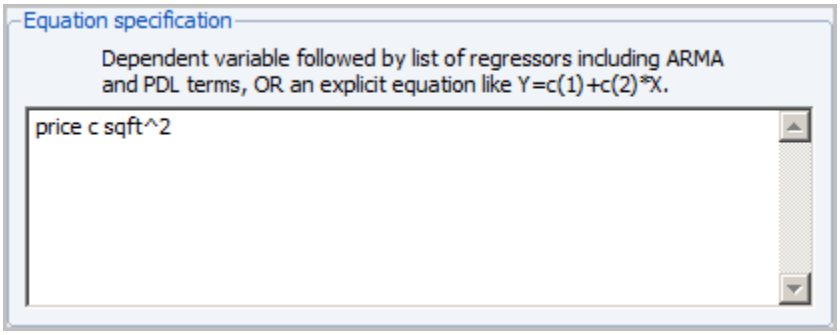
Consider a model from real estate economics in which the price (*PRICE*) of a house is related to the house size measured in square feet (*SQFT*). Open the EViews workfile ***br.wf1***. Save it with a new name, such as ***br_chap02.wf1***.

2.9.1 Fitting a quadratic model

A **quadratic** model for house prices includes the **squared** value of *SQFT*, giving

$$PRICE = \alpha_1 + \alpha_2 SQFT^2 + e$$

This is a simple regression model $y = \alpha_1 + \alpha_2 x + e$, with y = *PRICE* and $x = SQRT^2$. Models with transformed variables are easily estimated in EViews using variable transformations inserted directly in the equation specification. Select **Quick/Estimate Equation** from the EViews menu. In the dialog box enter the equation using *SQFT*^2 to represent the quadratic term.



The resulting estimates are:

Sample: 1 1080
Included observations: 1080

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	55776.57	2890.441	19.29690	0.0000
SQFT^2	0.015421	0.000313	49.25420	0.0000

It is useful now to begin doing the least squares estimation using the Command window approach. The quadratic model estimated above can also be implemented by entering into the Command window

ls price c sqft^2

Alternatively, the equation can be estimated and named **QUADRATIC** with one command using

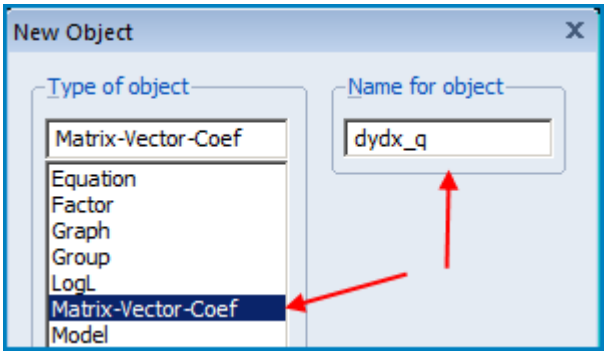
equation quadratic.ls price c sqft^2

2.9.2 Interpreting the quadratic model

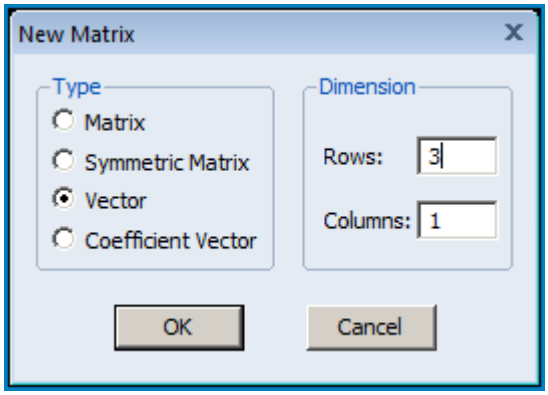
EViews can compute the slope and elasticity at any point using the same approach as in Section 2.3.2. The slope of the fitted line is also known as the **marginal effect** in economics. It is given by

$$\frac{d\left(PRICE\right)}{dSQFT} = 2\hat{\alpha}_2 SQFT$$

where $\hat{\alpha}_2 = 0.015421$ is the least squares estimate of the parameter α_2 that is attached to the variable **SQFT^2** from the regression output. To compute this value we can choose a particular house size, say *SQFT* = 2000. This scalar can be calculated within EViews using the saved coefficients **@coefs**, following estimation of the regression equation. So that we can create a few predicted values, first create a new **Object**. From the EViews menu choose **Object/New Object**. In the **New Object** dialog box, choose **Matrix-Vector-Coef** and assign a name: **dydx_q** is representative for the slope of the quadratic model.



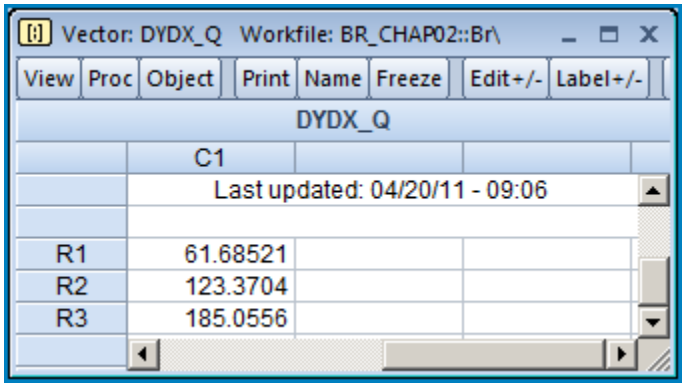
We will compute marginal effects for three house sizes, 2000, 4000, and 6000 square feet. So choose a vector with three rows and one column.



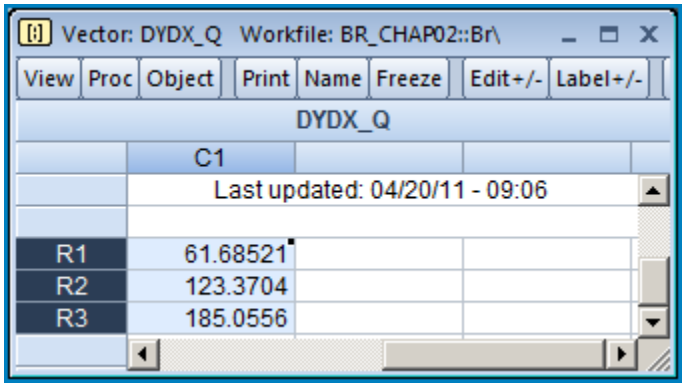
Click **OK** to open the **Vector**. In the Command window enter, one after the other,

dydx_q(1) = 2*@coefs(2)*2000
dydx_q(2) = 2*@coefs(2)*4000
dydx_q(3) = 2*@coefs(2)*6000

Note that Command window entries are simple text, and can be copied and pasted, or edited directly to produce new commands. That is, after typing the first command, highlight it, then copy and paste it into a new Command window below the previous. Or, even more simply, edit the first command by replacing (1) with (2) and 2000 with 4000, then press **Enter**. The resulting vector is now



While those are the answers, it is nice to "dress them up" a bit. In the Vector, highlight the numbers and copy using **Ctrl + C**.



Select the formatted option, then paste the table into word processing software. Edit the table to make it presentable.

Marginal Effect of an Additional Square Foot of Living Space	
Square feet	Predicted change in price
2000	61.68521
4000	123.3704
6000	185.0556

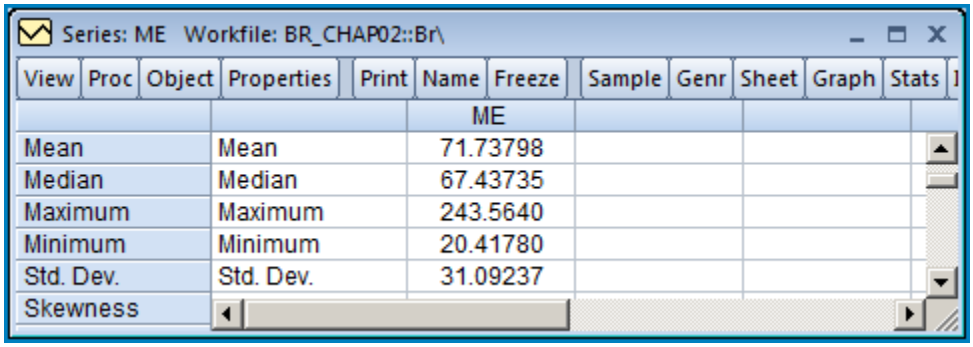
Alternatively, the average of the marginal effects for the entire sample can be created. That is,

$$AME = \frac{1}{N}\sum_{i=1}^{N} ME_i = \frac{1}{N}\sum_{i=1}^{N} 2\hat{\alpha}_2 SQFT_i$$

Create the series $2\hat{\alpha}_2 SQFT_i$ using

```
series me = 2*@coefs(2)*sqft
```

Compute the summary statistics for this series.



The average (over all properties in the sample) estimated increase in *PRICE* for an additional square foot of living area is $71.74. The Standard Deviation **Std. Dev.** is one measure of how much variation there is in the estimated marginal effects.

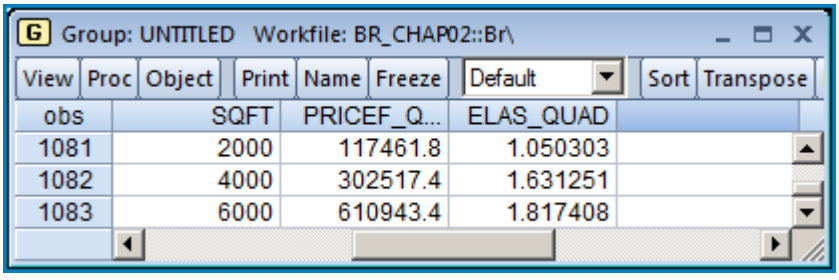
Computing the elasticity of *PRICE* with respect to house size, *SQFT*, is much the same. The elasticity of house price with respect to house size is the percentage increase in estimated price given a 1% increase in house size. Like the slope, the elasticity changes at each point. In our example,

$$\hat{\varepsilon} = slope \times \frac{SQFT}{PRICE} = \left(2\hat{\alpha}_2 SQFT\right) \times \frac{SQFT}{PRICE}$$

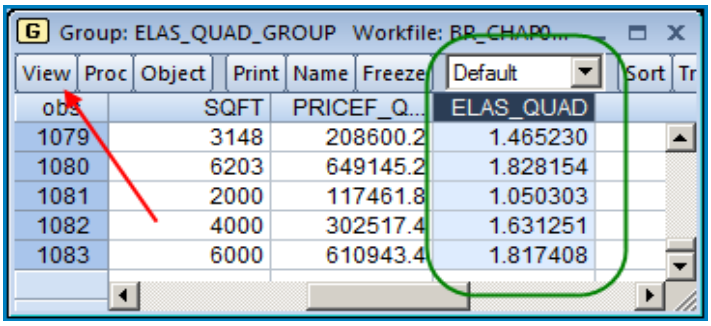
To compute an estimate we must select values for *SQFT* and *PRICE*. A common approach is to choose a point on the fitted relationship. That is, choose a value for *SQFT* and choose for price the corresponding fitted value $PRICE$. An efficient way to carry out the calculations is to (i) insert three additional observations into the workfile (change Range), (ii) enter 2000, 4000, and 6000 as the additional *SQFT* values, (iii) obtain fitted values from the **QUADRATIC** equation using **Forecast**, say *PRICEF_QUAD*. Then implement the command

```
series elas_quad = 2*@coefs(2)*(sqft^2)/pricef_quad
```

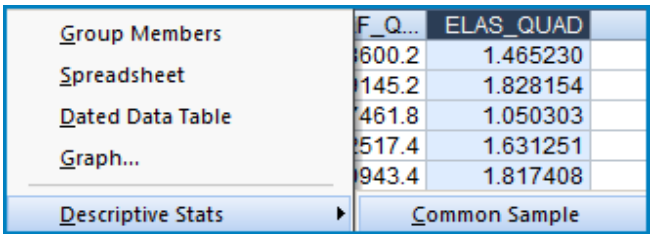
Open the group consisting of *SQFT*, *PRICEF_QUAD*, and *ELAS_QUAD*. The last three rows are



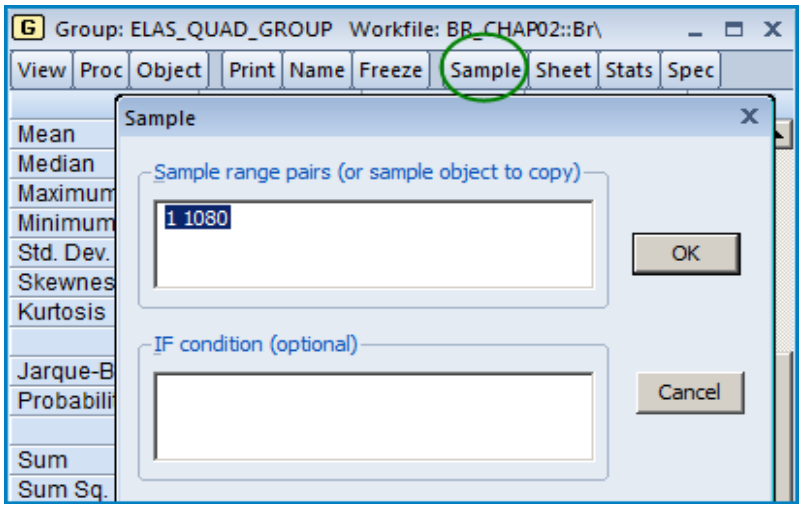
The average elasticity for the 1080 individuals is obtained similarly. In the group of series above, highlight the column *ELAS_QUAD*. Select **View**.



Choose **Descriptive Stats/Common Sample**.



Select **Sample** and adjust the **Sample range**; click **OK**.

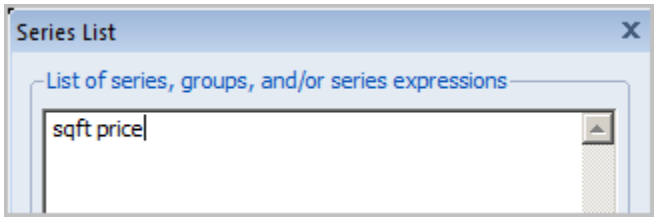


	SQFT	PRICEF_QUAD	ELAS_QUAD
Mean	2325.938	154863.2	1.102401
Median	2186.500	129502.8	1.138600
Maximum	7897.000	1017489.	1.890364
Minimum	662.0000	62534.86	0.216145
Std. Dev.	1008.098	102272.7	0.352835
Observations	1080	1080	1080

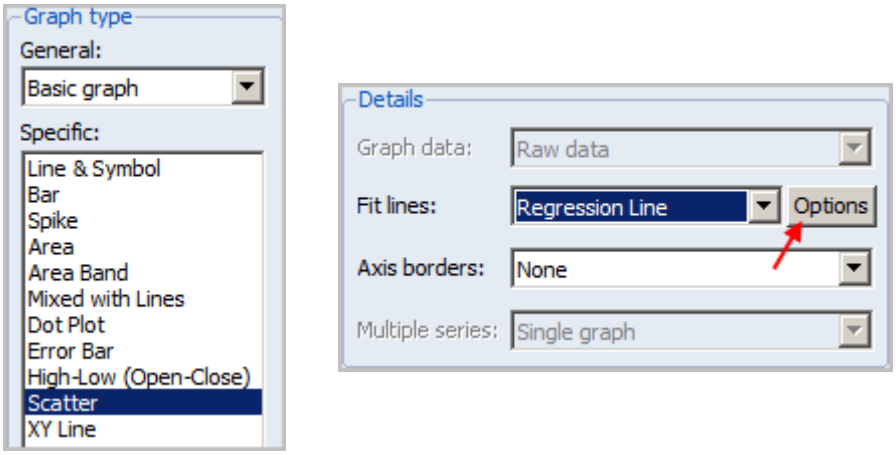
The average of the elasticities computed at each of the 1080 sample points is 1.1024.

2.9.3 Plotting the fitted quadratic model

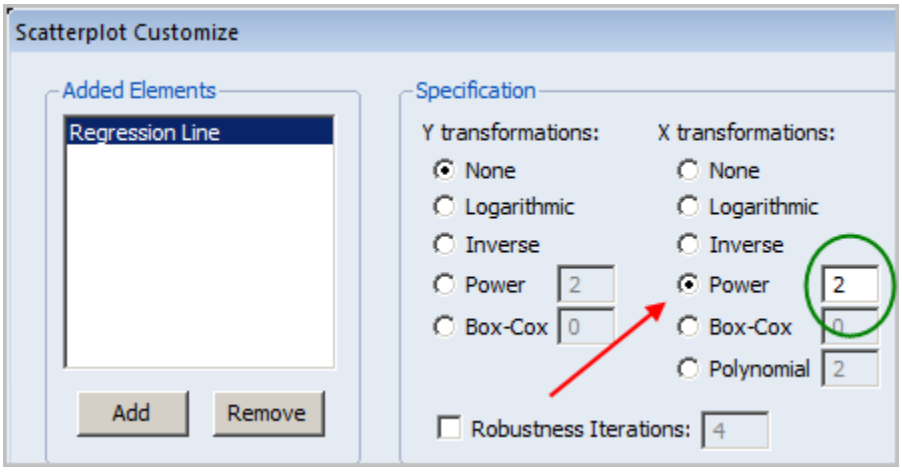
How well does this equation fit the data? The plot of the quadratic fit can be accomplished by using **Quick/Graph**. In the dialog box enter



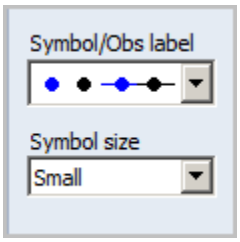
Choose the **Scatter Graph type**. Add a **Fit line**.



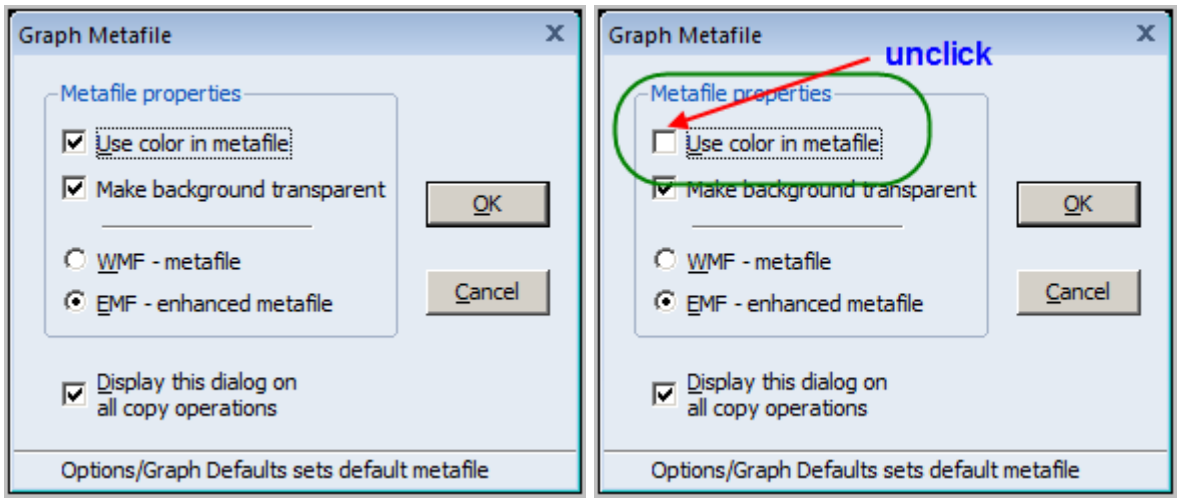
Click **Options** next to **Regression Line**. Choose **Power** for the **X transformations**. The default power is 2 so that no change is required. Select **Add**. Note that now we have two **Added Elements**.



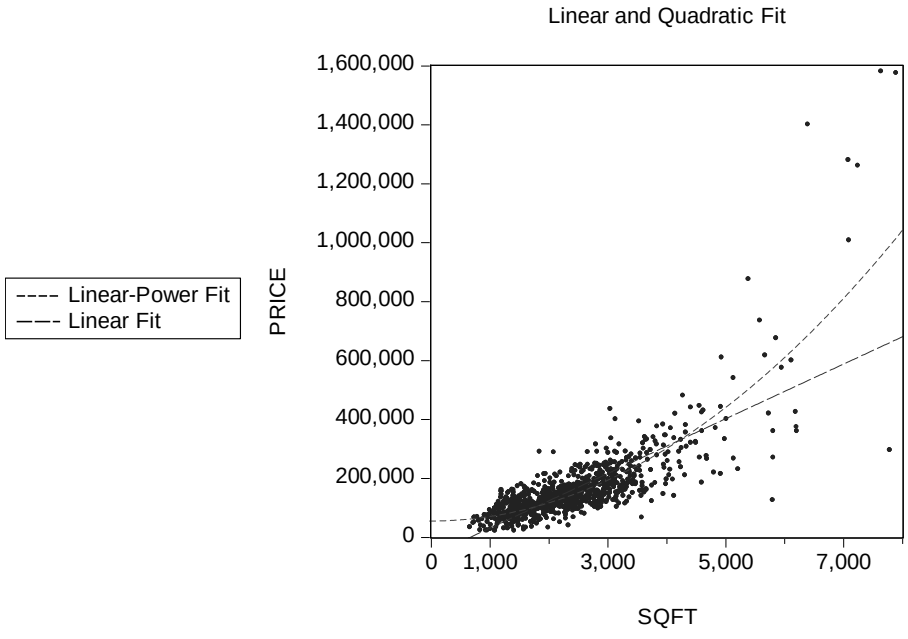
We choose to make the symbols small since there are a large number of data points:



Also, we add text to the graph. Click inside the graph to highlight the border, and enter the copy short-cut **Ctrl + C**. Now you have two options. If you are creating a color document, then leave the default copy settings. If your document is not in color, a reader will not really be able to tell one fitted line from the other (except that one is curved). Remove the color option:



The plot with the color removed is shown below. EViews adds a legend indicating the plot.

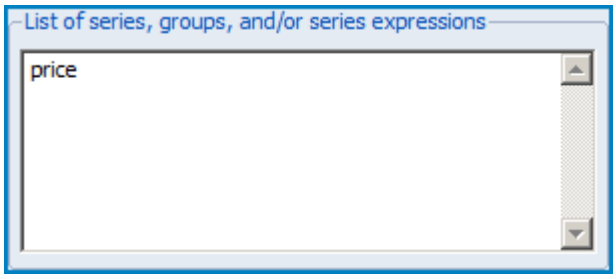


2.9.4 Estimating a log-linear model

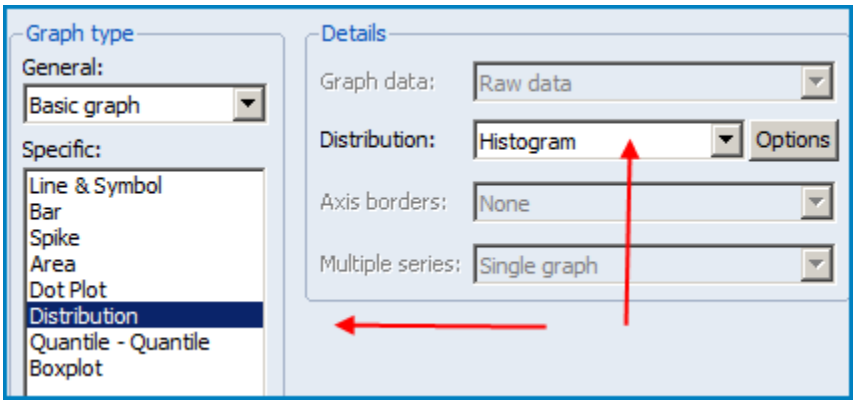
An alternative choice for a nonlinear relationship between house price and size is the log-linear model:

$$\log(PRICE) = \gamma_1 + \gamma_2 SQFT + e$$

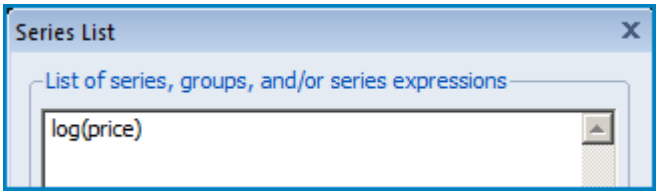
Logarithmically transformed dependent variables are common when the original distribution is skewed, which is frequent with economic variables like income, and housing prices. To see this, select **Quick/Graph** from the EViews menu. First, enter the variable name *PRICE*.



Select **OK**. Among the **Graph types** choose **Distribution**. Under **Details** the **Distribution** is identified as **Histogram**.

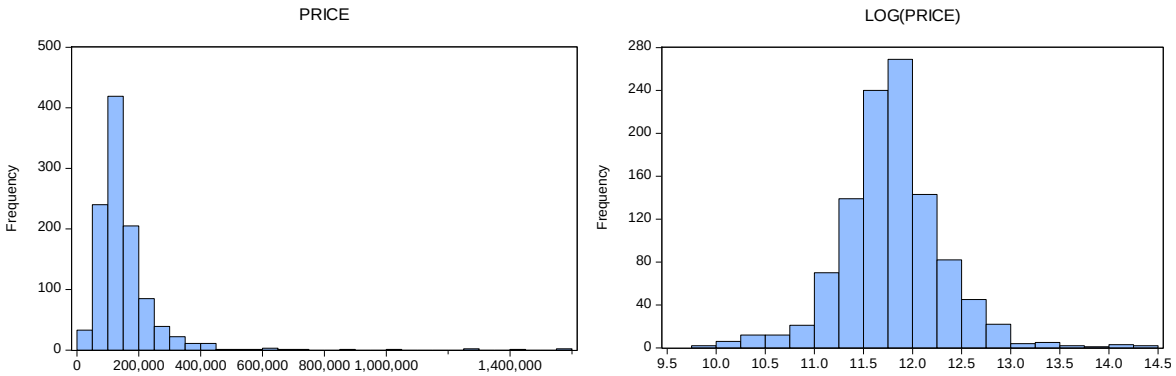


Repeat these same steps but enter **log(price)** into the series list. In EViews the function **log** is the natural logarithm.



The two histograms are shown below. Notice that *PRICE* has a skewed distribution, with a long tail to the right. The distribution of *LOG*(*PRICE*) is much more symmetrical. If we can assume that the data are normally distributed, we will find that the statistical inference procedures of

interval estimation and hypothesis testing have improved properties. These ideas will be introduced in Chapter 3.



Estimation for this case uses the natural logarithmic transformation of *PRICE*. In the Command window enter

```
equation loglinear.ls log(price) c sqft
```

The resulting estimated equation is

Dependent Variable: LOG(PRICE)
Method: Least Squares
Sample: 1 1080
Included observations: 1080

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.83860	0.024607	440.4593	0.0000
SQFT	0.000411	9.71E-06	42.36484	0.0000

Note that the **Dependent Variable** is **LOG(PRICE)**.

2.9.5 Interpreting the log-linear model

The simplest interpretation in the log-linear model is that a 1-unit increase in the explanatory variable (*SQFT*) leads to approximately a $100\hat{\gamma}_2\%$ change in the dependent variable (*PRICE*), holding all else fixed. We can say that, for a 1 square foot increase in size, we estimate a price increase of 0.04 percent. Or, perhaps more usefully, we estimate that a 100 square foot increase will increase price by approximately 4%.

The slope and elasticity in this log-linear model are

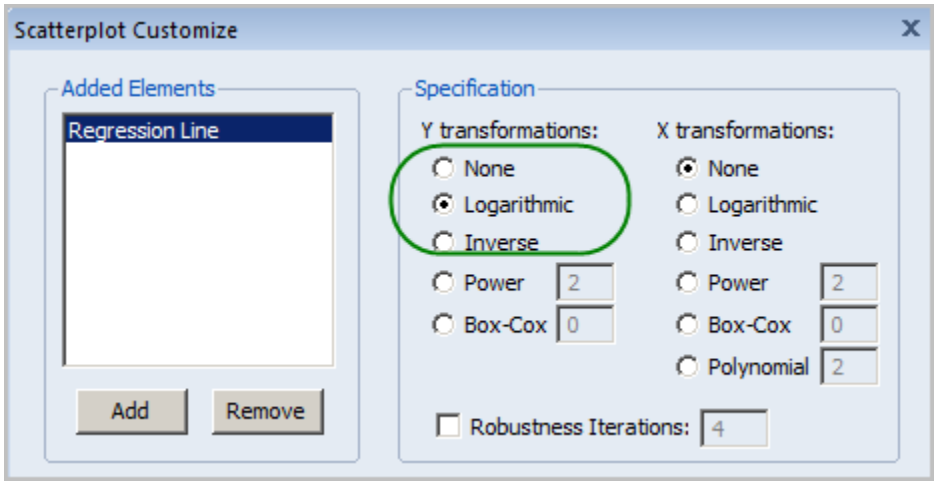
$$\frac{d\left(PRICE\right)}{dSQFT} = \hat{\gamma}_2 PRICE = 0.000411 PRICE$$

$$\hat{\varepsilon} = \hat{\gamma}_2 SQFT = 0.000411 SQFT$$

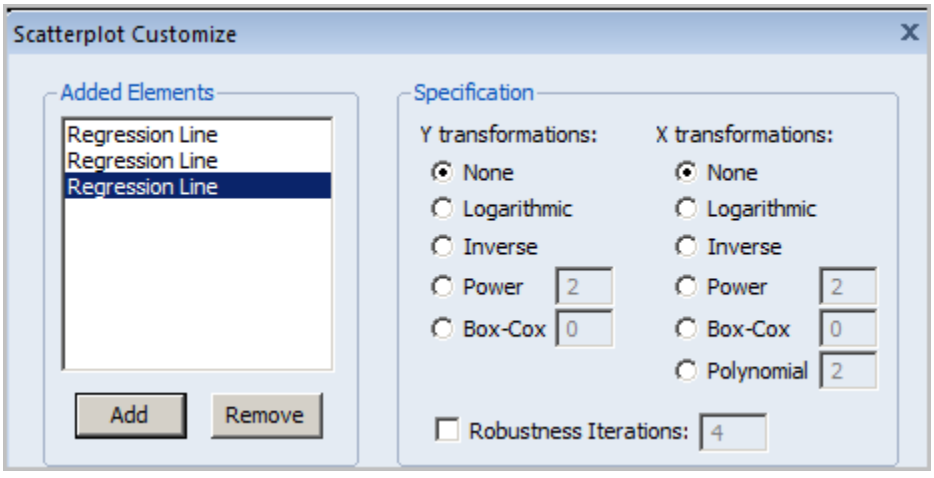
The slope calculation requires a predicted value of *PRICE*. In the next section we see how to accomplish that.

2.9.6 Prediction in the log-linear model

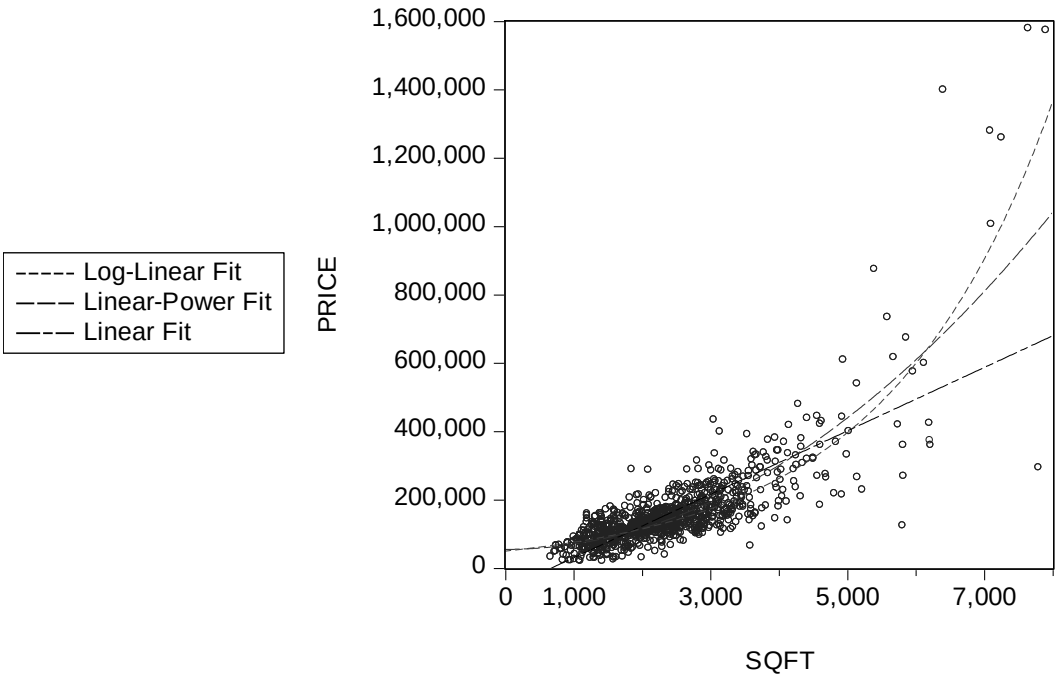
To plot the fitted line we use the same steps as for the quadratic fitted line except that we apply a **Logarithmic Y transformation**.



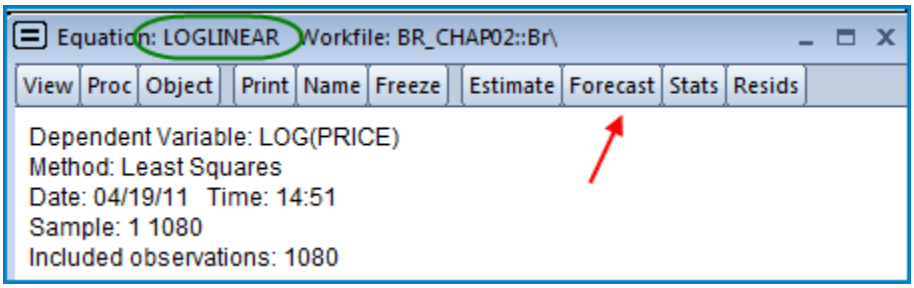
Click **Add**. We can add the quadratic fitted line as well. Click **Power**, enter "2" and click **Add**. Now we have three Added Elements.



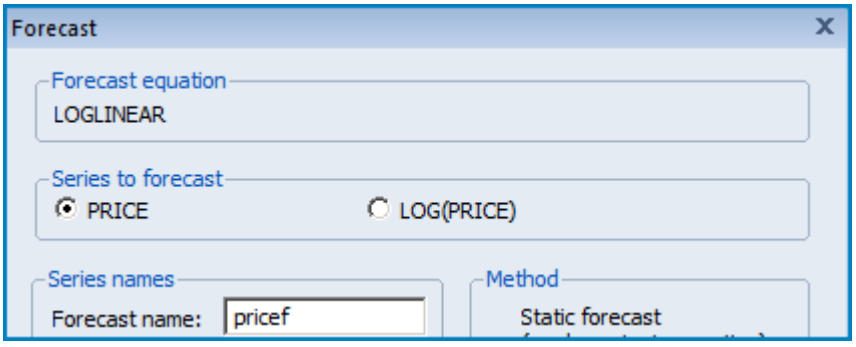
Click **OK**, then copy and paste a non-color graph. Note that we have the option of highlighting one of the **Regression Line** entries and selecting **Remove** instead of **Add**.



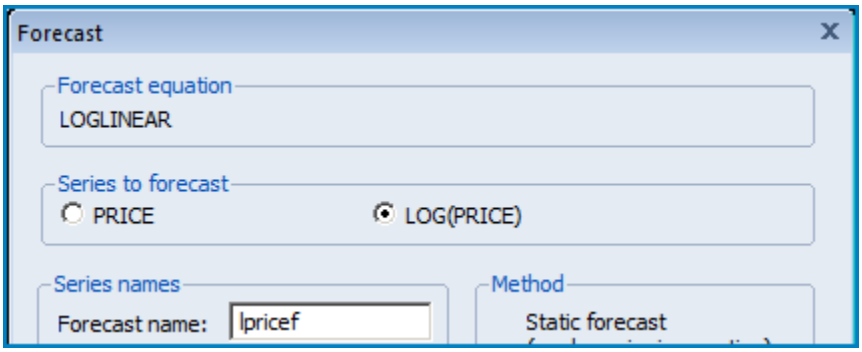
Forecasting with a log-linear model requires a little care, as the dependent variable in the model regression is *LOG*(*PRICE*). From within the **LOGLINEAR** regression equation click **Forecast**.



Two options are offered under **Series to forecast**.



First choose the default, which is to forecast *PRICE*, generating the new series *PRICEF*. Repeat the exercise by returning to the **Stats** panel, and click **Forecast** again.



Choose the **LOG(PRICE)** radio button and give the forecast a new name, such as *LPRICEF*. This generates the fitted values

$$\log(PRICE) = \hat{\gamma}_1 + \hat{\gamma}_2 SQFT = 10.83860 + 0.000411 SQFT$$

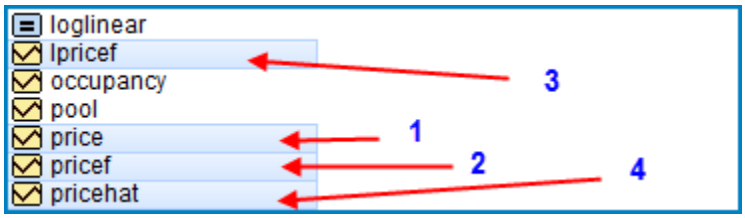
where $\hat{\gamma}_1$ and $\hat{\gamma}_2$ are least squares estimates of the log-linear regression equation parameters. The predicted value of *PRICE* is obtained using the anti-logarithm, which is the exponential function

$$PRICE = \exp\left[\log(PRICE)\right]$$

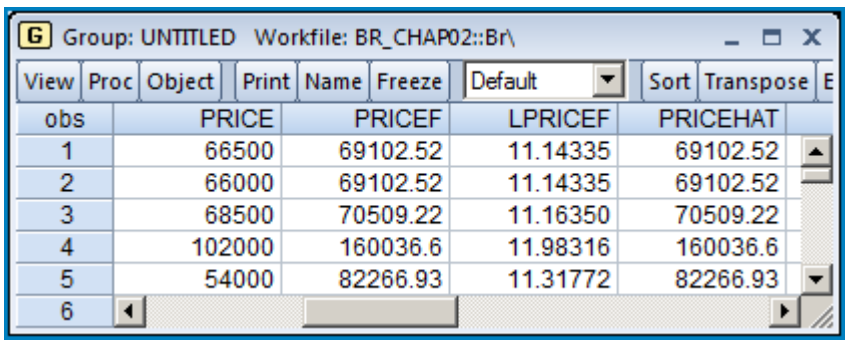
In the EViews Command window we enter

```
series pricehat = exp(lpricef)
```

Open the four series *PRICE*, *PRICEF*, *LPRICEF* and *PRICEHAT* by selecting them in order while holding down the **Ctrl** key.



Double-click within the shaded area to open the group.



obs	PRICE	PRICEF	LPRICEF	PRICEHAT
1	66500	69102.52	11.14335	69102.52
2	66000	69102.52	11.14335	69102.52
3	68500	70509.22	11.16350	70509.22
4	102000	160036.6	11.98316	160036.6
5	54000	82266.93	11.31772	82266.93
6				

The series *PRICEF* is the same as *PRICEHAT*, so we have confirmed what EViews is doing in the forecast step with a log-linear model.

By using the predicted *PRICE*, the slope expression in Section 2.9.5 can be computed at any given house size. Alternatively, the Average Marginal Effect (AME) can be computed using

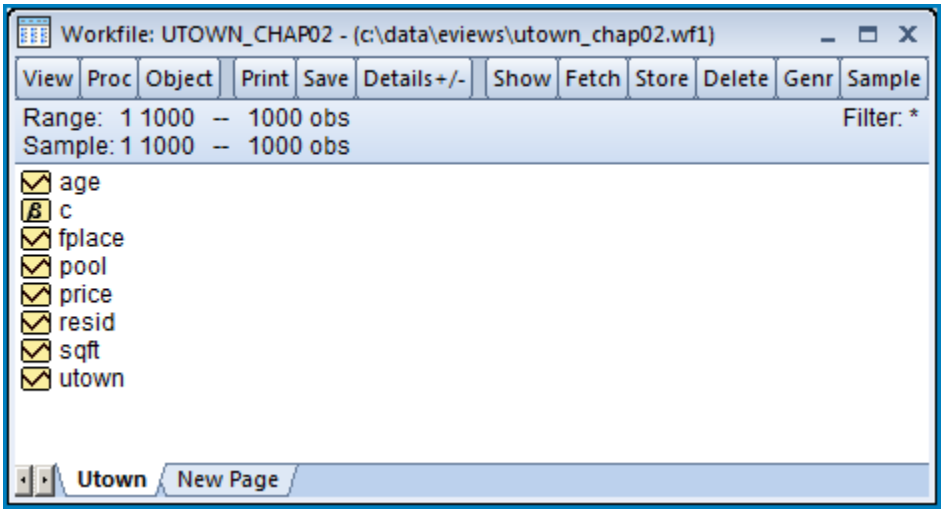
```
series me_llin = @coefs(2)*pricef      ME at each observation
coef(2) ame_llin                       Storage Vector
ame_llin(1)=@mean(me_llin)             Sample mean of ME
ame_llin(2)=@stdev(me_llin)            Std Dev of ME
```

The result is

Average marginal effect of increase in house size (1 square foot) on predicted house price	
AME	61.00073
STD DEV	42.91725

2.10 REGRESSION WITH INDICATOR VARIABLES

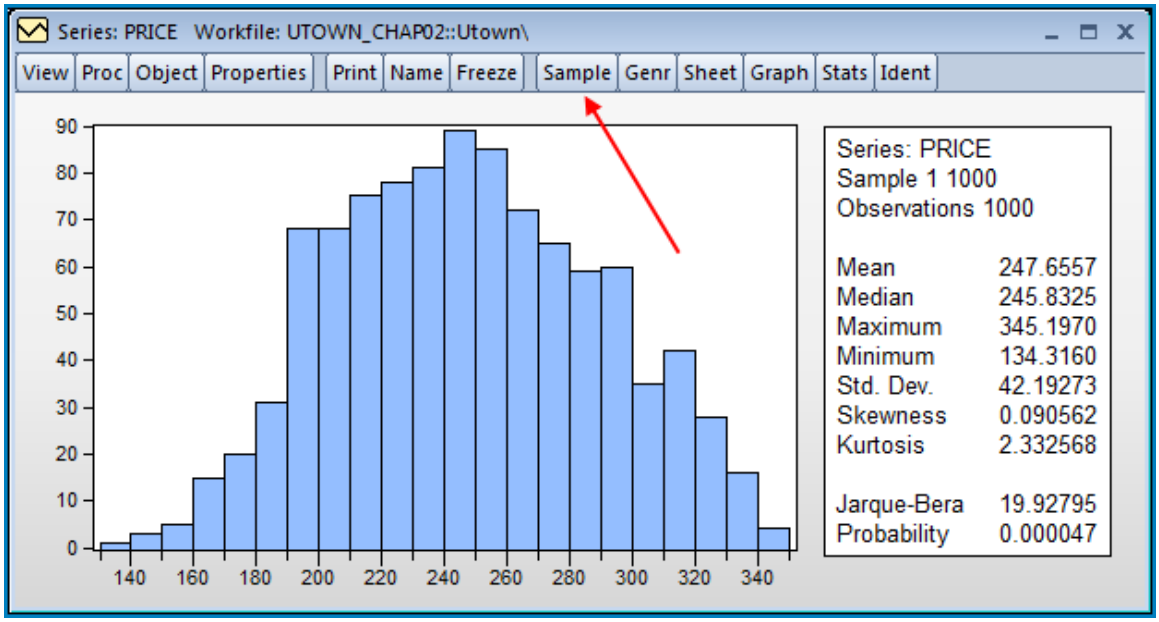
An indicator variable is a binary (0 or 1) variable that is used to represent a non-quantitative characteristic, such as gender, race, or location. For example, in the workfile ***utown.wf1*** we have a sample of 1000 observations on house prices (*PRICE*, in thousands of dollars) in two neighborhoods. Save the file under an alternative name, such as ***utown_chap02.wf1***.



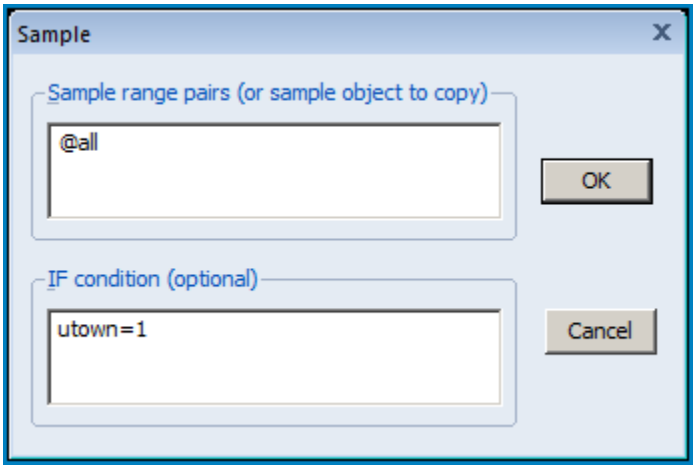
One neighborhood is near a major university and called University Town. Another similar neighborhood, called Golden Oaks, is a few miles away from the university. The indicator variable of interest is

$$UTOWN = \begin{cases} 1 & \text{house is in University Town} \\ 0 & \text{house is in Golden Oaks} \end{cases}$$

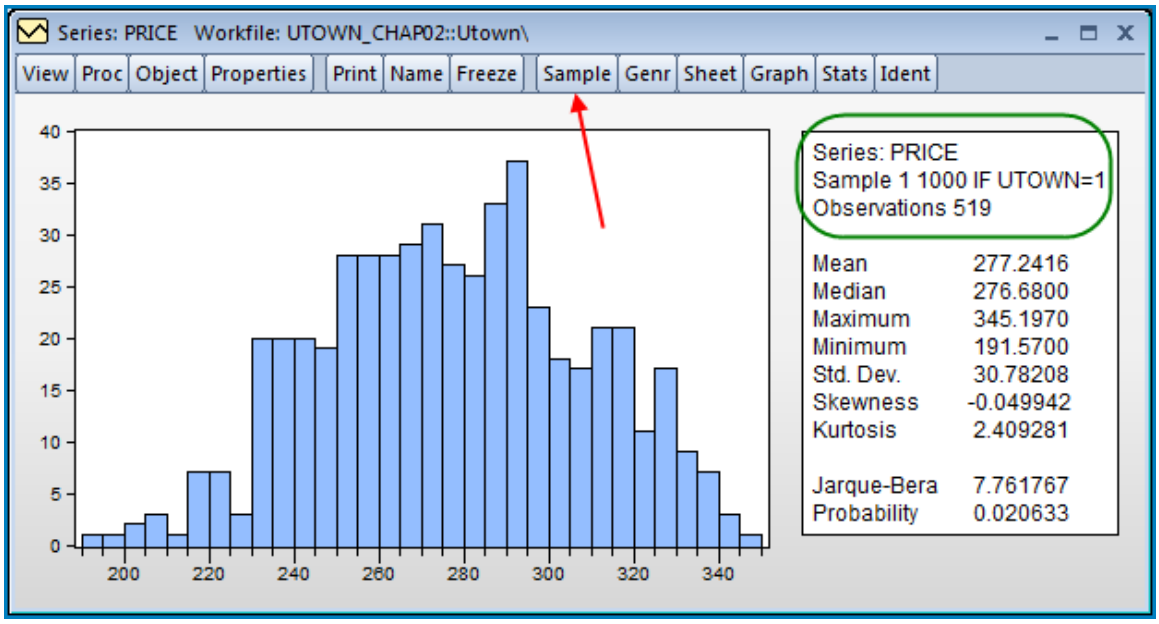
We use the **Sample** options to construct histograms for house prices in each neighborhood. Open the *PRICE* series. Click on **View/Descriptive Statistics & Tests/Histogram and Stats**. What appears is the histogram and summary statistics for the full sample of observations. Click the **Sample** button.



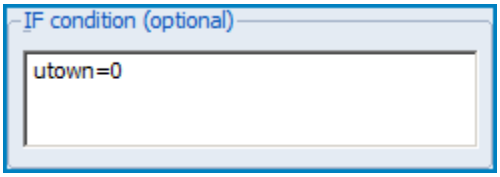
Add the **IF condition utown=1**,



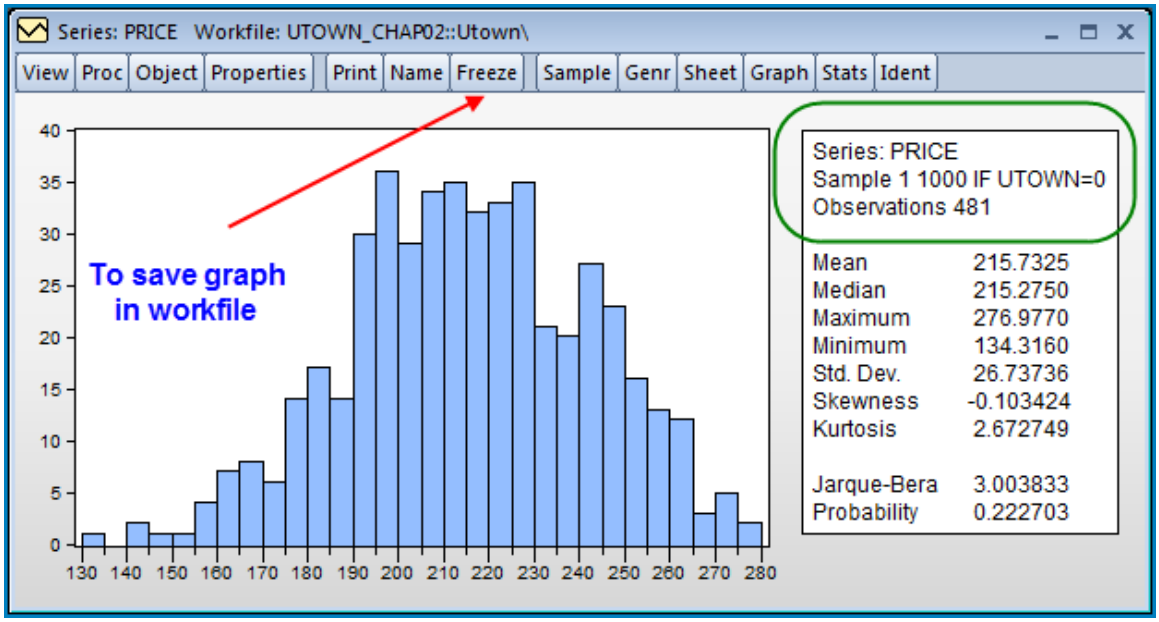
The resulting histogram is



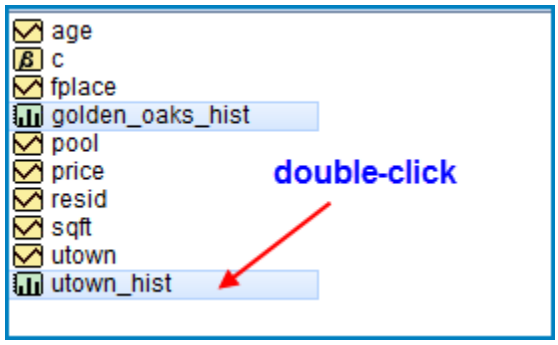
Click on **Sample** again. Change the **IF condition** to



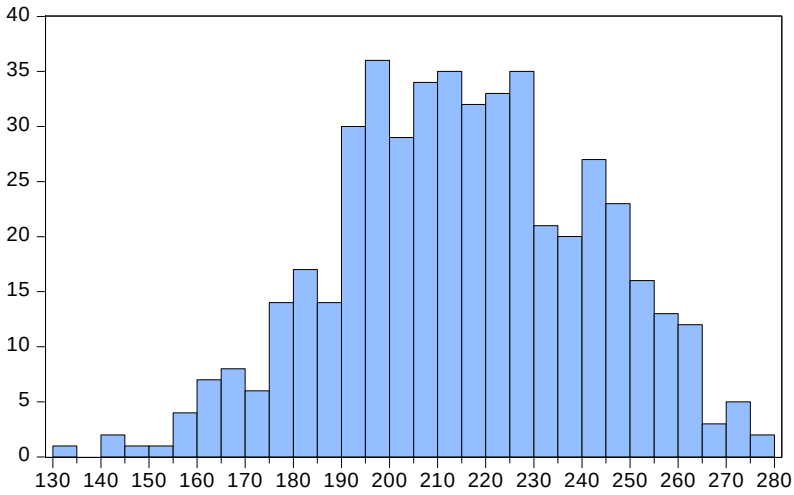
The result is



It is nice to have the two graphs in the same image. This can be achieved by selecting the two saved graphs and double-clicking in the shaded area.

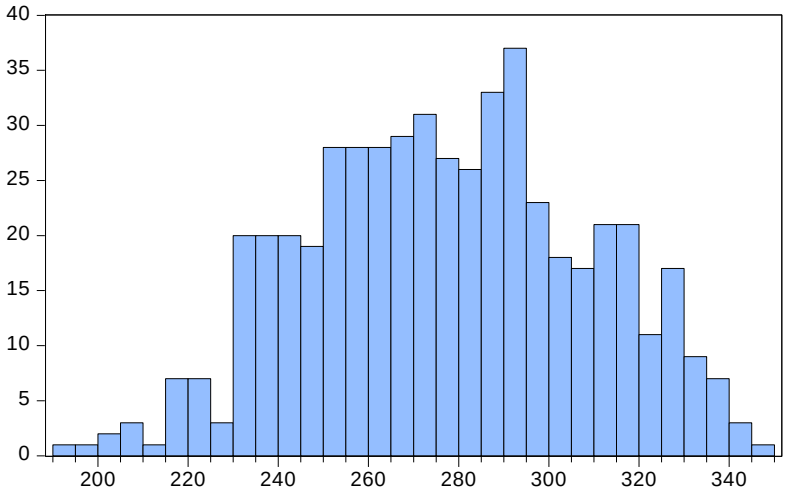


The result is



Series: PRICE
Sample 1 1000 IF UTOWN=0
Observations 481

Mean	215.7325
Median	215.2750
Maximum	276.9770
Minimum	134.3160
Std. Dev.	26.73736
Skewness	-0.103424
Kurtosis	2.672749
Jarque-Bera	3.003833
Probability	0.222703



Series: PRICE
Sample 1 1000 IF UTOWN=1
Observations 519

Mean	277.2416
Median	276.6800
Maximum	345.1970
Minimum	191.5700
Std. Dev.	30.78208
Skewness	-0.049942
Kurtosis	2.409281
Jarque-Bera	7.761767
Probability	0.020633

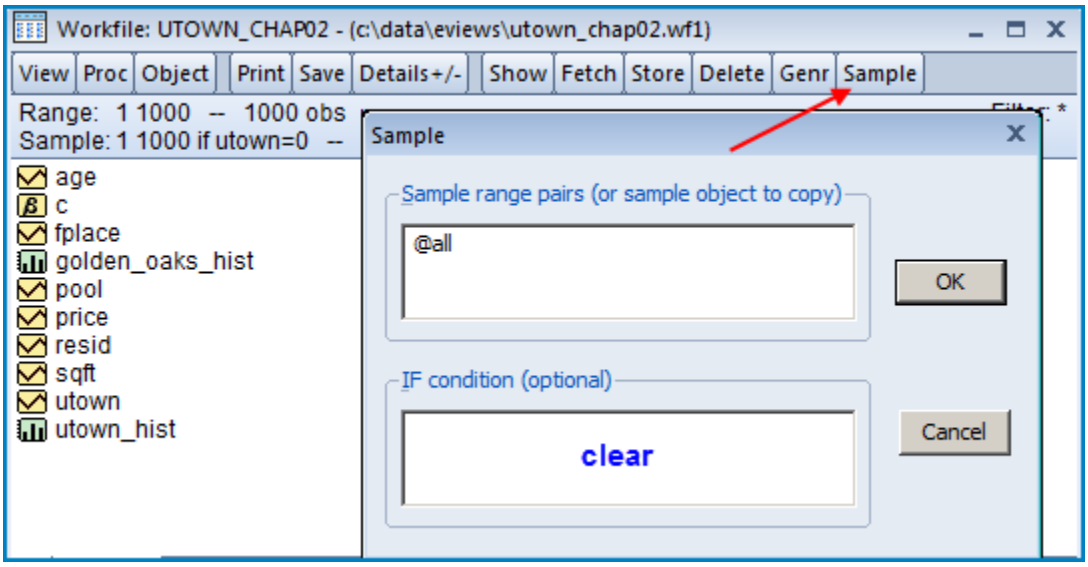
A regression model using *UTOWN* as an explanatory variable is

$$PRICE = \beta_1 + \beta_2 UTOWN + e$$

Regression using indicator variables as explanatory variables requires no special software commands. It is the interpretation that is unusual. The parameter β_2 is not a slope, because *UTOWN* is not a continuous variable. Slopes are derivatives, and derivatives are taken with respect to continuous variables. The regression function for this model is

$$E(PRICE) = \beta_1 + \beta_2 UTOWN = \begin{cases} \beta_1 + \beta_2 & \text{if } UTOWN=1 \\ \beta_1 & \text{if } UTOWN=0 \end{cases}$$

Before estimating the regression we must return the sample to include all observations. Click on the **Sample** button and clear any previous condition.



Estimate the regression using the command

equation utown_reg.ls price c utown

A portion of the output is

Dependent Variable: PRICE
Sample: 1 1000
Included observations: 1000

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	215.7325	1.318066	163.6735	0.0000
UTOWN	61.50911	1.829589	33.61908	0.0000

Note that the constant term 215.7325 is the sample mean price of houses in Golden Oaks. The coefficient of *UTOWN*, 61.50911, is the difference between the sample means of houses in University Town and Golden Oaks. The least squares estimates b_1 and b_2 in this indicator variable regression can be shown to be

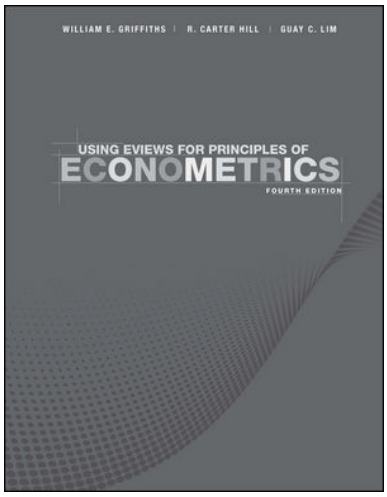
$$b_1 = \overline{PRICE}_{\text{Golden Oaks}} = 215.7325$$

$$b_2 = \overline{PRICE}_{\text{University Town}} - \overline{PRICE}_{\text{Golden Oaks}} = 277.2416 - 215.7325 = 61.5091$$

where $\overline{PRICE}_{\text{Golden Oaks}}$ is the sample mean (average) price of houses in Golden Oaks and $\overline{PRICE}_{\text{University Town}}$ is the sample mean price of houses from University Town.

Keywords

average marginal effect
coefficient vector
covariance matrix
descriptive statistics
edit +/-
elasticity
equation name.ls
equation representations
equation save
error variance
estimate equation
forecast
generate series
genr
graph axes/scale
graph copy to document
graph options
graph regression line
graph save
graph symbol pattern
graph title
group: open
indicator variable
log
log-linear model
marginal effect
Mean dependent variable
object: Matrix-Vector-Coef
object: name
quadratic model
quick/estimate equation
quick/graph
resid
resids
residual table
residuals
S.D. dependent variable
S.E. of regression
sample mean
sample range
sample standard deviation
scalar
scatter diagram
series
slope, regression
spreadsheet
standard errors
Std. Error
Sum of squared resid
workfile: open
workfile: save



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